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# Multiple socioeconomic circumstances and health: associations and explanations among Finnish and British public sector employees

*ACADEMIC DISSERTATION*

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**LIST OF ORIGINAL PUBLICATIONS**

I Laaksonen E, Martikainen P, Head J, Rahkonen O, Marmot MG, Lahelma E. Associations of multiple socio-economic circumstances with physical functioning among Finnish and British employees. *European Journal of Public Health* 2009;19:38-45.

II Laaksonen E, Martikainen P, Lahelma E, Lallukka T, Rahkonen O, Head J, Marmot MG. Socioeconomic circumstances and common mental disorders among Finnish and British public sector employees: evidence from the Helsinki Health Study and the Whitehall II Study. *International Journal of Epidemiology* 2007;36:776-86.

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**ABSTRACT**

Socioeconomic health inequalities have been widely documented, with a lower social position being associated with poorer physical and general health and higher mortality. For mental health the results have been more varied. However, the mechanisms by which the various dimensions of socioeconomic circumstances are associated with different domains of health are not yet fully understood. This is related to a lack of studies tackling the interrelations and pathways between multiple dimensions of socioeconomic circumstances and domains of health. In particular, evidence from comparative studies of populations from different national contexts that consider the complexity of the causes of socioeconomic health inequalities is needed.

The aim of this study was to examine the associations of multiple socioeconomic circumstances with physical and mental health, more specifically physical functioning and common mental disorders. This was done in a comparative setting of two cohorts of white-collar public sector employees, one from Finland and one from Britain. The study also sought to find explanations for the observed associations between economic difficulties and health by analysing the contribution of health behaviours, living arrangements and work-family conflicts.

The survey data were derived from the Finnish Helsinki Health Study baseline surveys in 2000-2002 among the City of Helsinki employees aged 40-60 years, and from the fifth phase of the London-based Whitehall II study (1997-9) which is a prospective study of civil servants aged 35-55 years at the time of recruitment. The data collection in the two countries was harmonised to safeguard maximal comparability. Physical functioning was measured with the Short Form (SF-36) physical component summary and common mental disorders with the General Health Questionnaire (GHQ-12). Socioeconomic circumstances were parental education, childhood economic difficulties, own education, occupational class, household income, housing tenure, and current economic difficulties. Further explanatory factors were health behaviours, living arrangements and work-family conflicts. The main statistical method used was logistic regression analysis. Analyses were conducted separately for the two sexes and two cohorts.

Childhood and current economic difficulties were associated with poorer physical functioning and common mental disorders generally in both cohorts and sexes. Conventional dimensions of socioeconomic circumstances i.e. education, occupational class and income were associated with physical functioning and mediated each other’s effects, but in different ways in the two cohorts:

education was more important in Helsinki and occupational class in London. The associations of economic difficulties with health were partly explained by work-family conflicts and other socioeconomic circumstances in both cohorts and sexes.

In conclusion, this study on two country-specific cohorts confirms that different dimensions of socioeconomic circumstances are related but not interchangeable. They are also somewhat differently associated with physical and mental domains of health. In addition to conventionally measured dimensions of past and present socioeconomic circumstances, economic difficulties should be taken into account in studies and attempts to reduce health inequalities. Further explanatory factors, particularly conflicts between work and family, should also be considered when aiming to reduce inequalities and maintain the health of employees.

**TIIVISTELMÄ**

Sosioekonomisia terveyseroja on tutkittu runsaasti, ja alemman sosioekonomisen aseman on todettu olevan yhteydessä heikompaan fyysiseen ja yleiseen terveyteen sekä korkeampaan kuolleisuuteen. Mielenterveyden osalta tulokset ovat olleet vaihtelevampia. Mekanismit, joiden välityksellä sosioekonomiset tekijät ovat yhteydessä terveyden eri osa-alueisiin, eivät kuitenkaan ole vielä täysin selvillä. Taustalla on puute tutkimuksista, jotka selvittäisivät yhtäaikaisesti useiden eri sosioekonomisten tekijöiden ja terveyden osa-alueiden välisiä yhteyksiä ja vaikutuspolkuja. Erityisesti tarvetta on tutkimuksille, jotka sekä vertailevat populaatioita eri maista että ottavat huomioon sosioekonomisten terveyserojen syiden moniulotteisuuden.

Tämän tutkimuksen tavoitteena oli selvittää yhteyksiä eri sosioekonomisten tekijöiden ja fyysisen sekä mielenterveyden välillä. Tutkimus toteutettiin asetelmassa, jossa verrattiin kahta julkisen sektorin toimihenkilöistä koostuvaa kohorttia, yhtä Suomesta ja yhtä Britanniasta. Lisäksi tutkimus pyrki löytämään selityksiä taloudellisten vaikeuksien ja terveyden välisille yhteyksille analysoimalla terveyskäyttäytymisen, asumismuodon sekä työn ja perheen yhteensovittamisvaikeuksien kontribuutiota.

Kyselytutkimusaineistoina käytettiin Helsingin kaupungin henkilöstön terveystutkimuksen perusaineistoa vuosilta 2000-2002, jossa mukana olivat 40-60-vuotiaat työntekijät, sekä Lontooseen keskittyvän ja alunperin 35-55-vuotiaita virkamiehiä koskeneen Whitehall II-tutkimuksen viidennen vaiheen aineistoa (1997-9). Aineiston keräys oli harmonisoitu maiden välillä maksimaalisen vertailtavuuden turvaamiseksi. Fyysistä toimintakykyä mitatiin Short Form (SF-36) -mittarilla ja yleisiä mielenterveysoireita General Health Questionnaire (GHQ-12) -mittarilla. Sosioekonomiset tekijät olivat vanhempien koulutus, lapsuuden taloudelliset vaikeudet, oma koulutus, ammattiasema, kotitalouden tulot, kodinomistus ja nykyiset taloudelliset vaikeudet. Selittäviä tekijöitä olivat terveyskäyttäyminen, asumismuoto sekä työn ja perheen yhteensovittamisvaikeudet. Tilastollisena päämenetelmänä käytettiin logistista regressioanalyysia. Analyysit suoritettiin erikseen kullekin sukupuolelle ja kohortille.

Lapsuuden ja nykyisten taloudellisten ongelmien raportointi oli yhteydessä heikompaan fyysiseen toimintakykyyn sekä yleisiin mielenterveysoireisiin yleisesti ottaen molemmissa kohorteissa ja kummallakin sukupuolella. Tavanomaiset sosioekonomiset tekijät eli koulutus, ammattiasema ja tulot olivat yhteydessä fyysiseen toimintakykyyn ja välittivät toistensa vaikutuksia joskin eri tavoin

eri kohorteissa: koulutus oli muita tärkeämpi Helsingissä ja ammattiasema Lontoossa. Taloudellisten vaikeuksien yhteys terveyteen selittyi osittain työn ja perheen yhteensovittamisvaikeuksilla ja muilla sosioekonomisilla tekijöillä molemmissa kohorteissa ja kummallakin sukupuolella.

Johtopäätoksenä voidaan todeta tämän kahdella maaspesifillä kohortilla suoritetun tutkimuksen vahvistavan, että sosioekonomisten olosuhteiden eri osa-alueet liittyvät toisiinsa, mutta eivät ole terveyseroja tutkittaessa korvattavissa toisillaan. Ne ovat myös eri tavoin yhteydessä terveyden fyysisiin ja psyykkisiin osa-alueisiin. Tavanomaisesti mitattujen nykyisten ja menneisyyden sosioekonomisten olosuhteiden lisäksi taloudelliset vaikeudet tulisi ottaa huomioon sekä tutkimuksissa että pyrkimyksissä vähentää terveyseroja. Myös muut yhteyksiä mahdollisesti selittävät tekijät, erityisesti vaikeudet työn ja perheen yhteensovittamisessa, tulisi ottaa huomioon kun tavoitteena on vähentää eriarvoisuutta sekä pitää yllä työntekijöiden terveyttä.

# 1 INTRODUCTION

In the past three decades, socioeconomic inequalities in health have been the focus of a multitude of studies. The tradition of health inequalities research has its roots further in the past, but in the early 1980s the Black Report revealing the prevailing large socioeconomic inequalities in health provoked a wider interest in investigating the issue (Townsend & Davidson 1982, Macintyre 1997). Since then, studies throughout the Western world have confirmed more disadvantageous socioeconomic circumstances to be associated with poorer physical and general health. Associations have been documented for chronic diseases, physical functioning, self-rated general health and mortality among other health outcomes (Ferrie et al. 2005, Lahelma et al. 2005, Mackenbach et al. 1997, 2003, 2008).

The socioeconomic circumstances most commonly inspected in relation to both physical and mental health have been education, occupational class and income (Araya et al. 2003, Dahl 1994, Lahelma et al. 2004, Mackenbach et al. 2008) but inequalities have also been shown by various aspects of material circumstances including housing tenure and economic difficulties (Ferrie et al. 2005; Macintyre et al. 2003, Laaksonen M. et al. 2005b), as well as childhood circumstances (Lundberg 1993, Mäkinen et al. 2006, Poulton et al. 2002, Pudrovska et al. 2005, Rahkonen et al. 1997).

For mental health, however, the general line of the findings has not been as consistent as for physical health. Severe mental disorders have been observed to be more common among those in lower socioeconomic positions (Dohrenwend et al. 1992, Lorant et al. 2003) but studies on less severe mental health problems, which are often called ‘common mental disorders’, have discovered variable and even negligible or somewhat reverse gradients (Fryers et al. 2003, Lahelma et al. 2006, Lewis et al. 1998). Thus, some unclarity still exists in the overall picture of the characteristics of socioeconomic inequalities within different domains of health.

Despite the vast number of studies conducted, the mechanisms by which the various socioeconomic circumstances are related to different domains of health are not yet fully understood. One of the reasons for this is that despite the large volume of studies conducted, only a minority have considered socioeconomic circumstances as a construction with multiple dimensions that are at the same time interrelated but not interchangeable (Braveman et al. 2005). Rather, studies have often been restricted to analysing only one or a few socioeconomic indicators at a time, or have aspired to find the most important indicator among many (Lahelma et al. 2004). Various mechanisms have

also been studied and suggested to explain socioeconomic inequalities in health, ranging from poverty-related material disadvantage to lifestyles and behaviours as well as to factors related to social environments and relationships such as work and family (Laaksonen M. et al. 2005a, Macintyre 1997, Stronks et al. 1996, Thrane 2006). However, studies aiming to explain health inequalities with other factors have mostly also ignored the multiplicity of socioeconomic circumstances.

In addition to the lack of studies tackling the interrelations and pathways between multiple socioeconomic circumstances, other explanatory factors and health, there are deficiencies in the evidence from international comparative studies. A growing number of comparisons between European countries in general, as well as those particularly focusing on Finland and Britain and the Nordic countries have been published since the 1990s (e.g. Arber & Lahelma 1993, Chandola et al. 2004, Eikemo et al. 2008, Lahelma et al. 2002, Mackenbach et al. 1997 & 2008). Thus far, these studies have, however, been largely descriptive, and also limited in terms of multiple socioeconomic circumstances. These analyses of European countries show that the extent of socioeconomic inequalities in health tends to vary to some extent between countries, but the pathways through which inequalities are produced have not been tackled adequately. Therefore, there is little evidence from comparisons which would consider the complexity of the causes of socioeconomic health inequalities in the different domains of health.

Overall, international comparisons including multiple socioeconomic circumstances and health outcomes could provide opportunities for assessing the similarity and dissimilarity of the production of socioeconomic inequalities in health in different countries. They could identify common and unique determinants and the ways these are related to different social contexts and policies. There would thus be health policy-related advantages as comparisons provide opportunities for identifying the particular problems in each country along with possibilities for diminishing the inequalities. Furthermore, comparisons would also help in assessing the overall generalizability of possible explanations for health inequalities.

These observations on the nature of the studies published on socioeconomic inequalities in health show that studies that are at the same time both explanatory and comparative are needed. To help fill this gap, this study aims to examine the socioeconomic inequalities in health in a way that takes into account as many of the above-mentioned deficiencies as possible. Firstly, multiple socioeconomic circumstances ranging from childhood to adulthood are included. Secondly, the

associations of these multiple socioeconomic circumstances are investigated in both physical and mental domains of health. Thirdly, further explanations for observed associations are also tackled. Finally, the study is conducted in a comparative setting focusing on cohorts from two countries, Finland and Britain, and including both women and men.

Finland and Britain share many similarities as affluent Western European societies. However, they differ for example in their income distributions and in representing different kinds of welfare state regimes, i.e. the 'Nordic' and the 'liberal', which differ in the patterns of welfare provision and allocation, labour markets and social structures. These might all contribute to the socioeconomic inequalities in health (Esping-Andersen 1990). In Finland, there is for example more universal welfare coverage, smaller income inequalities and a higher level of women's full-time participation in the labour market compared to Britain. In this study, the focus is on white-collar public sector employees with regular incomes, both female and male, which leaves out those with the most disadvantaged and advantaged socioeconomic circumstances in the society. This might make the role of national contexts and the related differences in economic and social background somewhat less pronounced, thus increasing the comparability of the two country-specific cohorts.

## 2 CONCEPTUAL FRAMEWORK OF THE STUDY

### 2.1 Multiple socioeconomic circumstances

In the study of socioeconomic inequalities in health, various concepts have been used when referring to the socioeconomic stratification of the society and to the standing of the individuals within this stratification (Krieger et al. 1997). Above all, classical sociological theories on *social class* form a part of the background of the research tradition of socioeconomic inequalities in health. In general, social class has been understood as referring to the hierarchical stratification or distinction between individuals and groups in the society. Class divisions have been made based on various criteria, such as advantage/disadvantage in terms of economic or cultural status and assets.

Karl Marx (1867/1971) defined class by people's relationship to property and the means of production, i.e. the productive resources in the society, dichotomizing the society into the owner class and the class of propertyless workers. This idea was included also in the functionalist theory, although the functionalists suggested that the social stratification related to property owning and to the division of labour would be naturally emerging and necessary in modern societies. Max Weber (1914/1978) in turn emphasized more than the structural relations and ownership the individual as a social actor in the competition, the marketplace of the society. He suggested that the capitalist system and the relationship to productive resources influence the distribution of opportunities, assets and skills, creating groups of individuals i.e. classes sharing similar circumstances and values. According to his theory, not only economic factors but also 'social honour' and related 'style of life' would be partly responsible for the distribution of power in the society. Later on, the importance of non-economic assets, skills and credentials have been emphasized also by for example Wright (1985) as well as Bourdieu (1984) who put weight particularly on cultural capital and taste as the defining factors of social classes.

In the last few decades when the study of socioeconomic inequalities in health has bloomed, rather than social class the concept of 'socioeconomic position' has been widely used to refer to the position of the individual in the social hierarchy in general. It has been used to refer to a variety of socioeconomic measures, those related to material resources as well as prestige (see e.g. Krieger et al. 1997, Lynch & Kaplan 2000). Also 'socioeconomic status' has been used in much the same way, but has been suggested as not being accurate when referring to material resources and not only to status in the sense of prestige and social honour (Krieger 2001). In this study, 'socioeconomic

circumstances' is used to refer to the various dimensions of socioeconomic position. By this choice of term, the complexity of socioeconomic position is better captured.

Socioeconomic circumstances are understood as a multidimensional entity, of which parts are interrelated but not interchangeable. Different indicators reflect different dimensions of a person's socioeconomic circumstances and differ in their associations with health outcomes and in related causal mechanisms (Braveman et al. 2005, Davey-Smith et al. 1998, Galobardes et al. 2007, Geyer et al. 2006, Krieger et al. 1997, Lynch & Kaplan 2000, Singh-Manoux et al. 2002). By treating these different dimensions of socioeconomic circumstances in this way and analysing them simultaneously, the understanding of the production of socioeconomic inequalities in health can be increased. In particular, in order to further unravel the exact ways in which socioeconomic circumstances together influence health, this multiplicity has to be taken into account as the large amount of studies that have been interested in only one or a few indicators at a time have not been able to provide a concise picture of the production of socioeconomic inequalities in health.

The key dimensions of socioeconomic circumstances and their interrelations are presented in Figure 1. The conventional indicators that have most often been used to measure the socioeconomic circumstances of an individual are education, occupational class and income. Although these indicators are closely related, they also reflect partly different phenomena (Krieger et al. 1997, Lynch & Kaplan 2000, Dahl 1994). Education primarily indicates non-material resources such as knowledge and skills. However, as it often determines occupational class and further income, it also reflects material resources. Education affects people's knowledge and abilities to process information, and is thus likely to influence health through health behaviours and lifestyle choices.

Occupational class reflects work-related status and power and influences health through work-related material and psychosocial factors such as income and working conditions. For married women, the husband's occupational class has sometimes been used; this has been called the 'conventional approach' as a contrast to the 'individual approach' which applies their own occupational class for all women (Arber 1997). Individual and household income are partly determined by education and occupational class. Income and wealth shape possibilities for healthy behavioural choices such as food choices and leisure activities along with living conditions and environments, as well as allowing access to better or more frequent health services. However, a difference should be made between individual and household income particularly among women, as individual income may give insufficient information due to larger variations in women's

participation in the labour market (Rahkonen et al. 2000). Income, along with wealth, reflects material circumstances most directly. Measures of wealth, in which housing tenure can also be counted, reflect accumulated affluence which contributes to health largely in the same way as individual and household income. Housing tenure as a measure of accumulated wealth has been suggested to be a more stable indicator of material resources and prosperity than individual or household income (Krieger et al. 1997). Housing tenure can also reflect housing conditions and the living environment such as the socioeconomic circumstances at the neighbourhood level. These may be less favourable in rented housing and thus contribute to health inequalities (Macintyre et al. 2003).

Economic difficulties are a dimension of the multidimensional construct of socioeconomic circumstances, but they are not fully captured by income or other standard socioeconomic measures. They indicate immediate material hardship, but are not related to low income only. Daily life economic difficulties such as difficulties in paying bills and affording food and clothes for oneself and one's family can exist at all income levels (Pearlin & Schooler 1978), as they can originate for example from excessive consumption and debt in relation to the income level (Drentea & Lavrakas 2000, Zimmerman & Katon 2005). They can also emerge because of adverse life events and circumstances, such as the spouse's unemployment or serious illness in one's family. Current economic difficulties reflect primarily current material resources and spending power, and may, similarly to income and wealth, influence health through health behaviours and living conditions (Laaksonen M et al. 2005a, Sacker et al. 2001). They can also affect health through stress mechanisms by acting as an acute or a chronic stressor (Pearlin 1989, Kahn & Pearlin 2006).

Childhood socioeconomic circumstances are an essential part of socioeconomic circumstances to be considered along with adult circumstances. The importance of childhood circumstances has been particularly stressed by the lifecourse approach to socioeconomic inequalities in health (Kestilä 2008). The lifecourse perspective emphasizes people's beginnings and trajectories of life in both biological and social sense (Kuh et al. 2003). Biological or genetic factors can have independent or interactive effects on adult health through various mechanisms (e.g. Barker et al 2001), but these are not examined in the current study and are thus not discussed in detail.

Adverse social and socioeconomic circumstances in childhood have been shown to be associated with poorer adult health independently (Davey-Smith et al. 1998, Poulton et al. 2002). They can also be associated with adult health indirectly through later life socioeconomic circumstances and

other factors or by leading to accumulation of disadvantage across the lifecourse (Kuh et al. 2003, Pudrovska et al. 2005). Accumulation of socioeconomic disadvantage may start with childhood circumstances affecting early development, educational achievement and opportunities, and subsequently occupational career, level of income, and later life living conditions (Pudrovska et al. 2005, Ross & Wu 1996). Early life circumstances and related stressors may also affect coping resources, self-esteem as well as personality-related tendencies such as negative affectivity, and can thus have more direct health-related consequences (Alonzo 2000, Poulton & Caspi 2005, Pudrovska et al. 2005, Ross & Wu 1996). Furthermore, the childhood socioeconomic circumstances and particularly the educational background of the parents may affect the lifestyle choices prevalent in the family and the development of health-related behaviours and risk factors, in largely the same way as a person's own education can affect health behaviours in adulthood through knowledge and skills (Krieger et al. 1997, Lynch & Kaplan 2000, Power et al. 2005). Childhood socioeconomic circumstances can also be related to other health-affecting family circumstances such as social support, parents' ability to care for the child and afford health care, parental loss, conflicts and abuse and overall family functioning (Poulton & Caspi 2005).

Because the early life conditions influence adulthood health together with adulthood circumstances, it is important to consider the whole lifecourse when examining socioeconomic inequalities in health. In the present study, as the starting point for the analyses of multiple socioeconomic circumstances reflecting different points in the lifecourse, certain pathways and a temporal order are assumed to prevail between them and health. These interrelations are illustrated in the schematic presentation of Figure 1. Childhood conditions, i.e. parental education and childhood economic difficulties, precede and influence the current adulthood circumstances. As education is usually acquired relatively early in the lifecourse, it precedes occupational class and income. Finally, all the previously mentioned circumstances are assumed to precede and contribute to current economic difficulties and housing tenure. Furthermore, various factors can mediate and in other ways contribute to the associations of the multiple socioeconomic circumstances and health, but as this schematic presentation aims to give a simplified picture of the interrelations between the multiple socioeconomic circumstances in particular, these factors have not been included here.

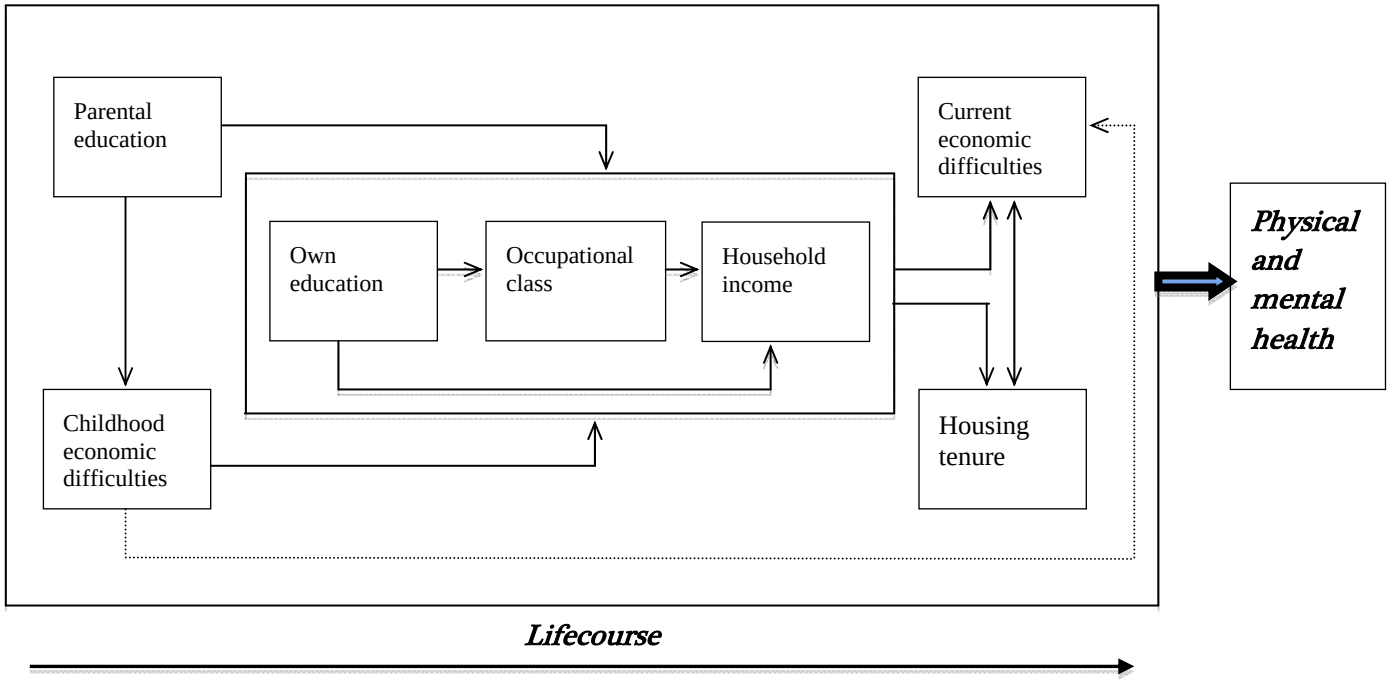



Figure 1. Schematic presentation of the assumed interrelations and temporal order between the different dimensions of socioeconomic circumstances

### 2.2 Physical functioning and common mental disorders

Health has been conceptualized in many ways, and the descriptions and perceptions of what health essentially is have varied. Health is obviously both a biologically and a socially defined state and closely related to illness or the lack of it. Studies have mostly approached health from the negative end i.e. ill-health, and efforts have generally been fewer to examine the positive side as expressed for example in the famous WHO definition of health as a state of complete physical, mental and social well-being and not just the absence of disease (Mackenbach et al. 1994). The domains of health and illness that have been studied in relation to socioeconomic circumstances are multiple, ranging from mortality to general self-rated health and various forms of morbidity including physical and mental symptoms and chronic diseases. This study is confined to the domains of physical functioning and common mental disorders, which are described in the following.

Physical functioning, often measured by the generic health questionnaire Short Form -36 (SF-36) (Ware et al. 1994), includes the ability to function in everyday tasks requiring some physical activity. Physical functioning indicates not only the state of health but also how a person's health and illness affect their everyday life, as physical impairments can have a strong effect on many

areas of life. Compared to various other measures of health, functioning provides a better insight into the impact of the state of health and illness on individuals and their social environment (Stansfeld et al. 1998). How functioning is impacted by particular illnesses and diseases may differ greatly between individuals, depending on the severity of the illness or disease and various personal and environmental factors. When referring to functioning and functional health, the term 'quality of life' has also been used by some researchers, and more often in clinical settings (e.g. Hemingway 1997). However, as this is a somewhat vague expression, and does not directly refer to physical abilities and their limitations, functioning is the term preferred in this study.

To differentiate minor and more general mental health problems from more severe 'psychotic' mental illnesses, they have been often referred to as 'common mental disorders' in studies (Fryers et al. 2003, Goldberg & Huxley 1992, Weich & Lewis 1998). These minor problems or disorders are sometimes classified into different categories such as depressive and anxiety symptoms and affective disorders (Fryers et al. 2003, Lahelma et al. 2006). They have often been measured with inventories such as the General Health Questionnaire (GHQ) (Goldberg 1972, Goldberg et al. 1997) and the Short Form –36 mental component summary (Ware & Kosinski 2001). These kinds of minor mental health problems have also been called minor psychiatric morbidity, non-psychotic psychiatric morbidity and psychological distress (Belek 2000, Weich & Lewis 1998). In this study, 'common mental disorders' is used, and applied in the literature review to cover a variety of minor disorders measured with different inventories. In addition, 'mental health' is used to mean the mental domain of health in general in contrast to the physical domain of health, and when a wider range of mental health outcomes of variable seriousness is referred to.

## 2.3 Explanations for socioeconomic inequalities in health

*General mechanisms of selection and causation*

Various explanations have been put forward for the persisting socioeconomic inequalities in health. First of all, the general issues of selection and causation have been debated since the publication of the Black Report in the 1980s (Townsend & Davidson 1982). The selection mechanism is about health status affecting the later socioeconomic circumstances of an individual. According to this explanation, poor health in the early part of life could result in later life socioeconomic disadvantage such as lower education, lower occupational class and so on. This view also includes

the notion of social mobility, i.e. healthier individuals moving upwards and the less healthy downwards in the society with regard to the socioeconomic circumstances. In addition to this 'direct selection', 'indirect selection' can also take place, various factors, such as for example obesity, having an influence on both socioeconomic circumstances and health.

The causation mechanism is the opposite of the selection mechanism, meaning that socioeconomic circumstances causally affect the health of an individual. This can take place through various intermediary factors, of which distribution varies according to the socioeconomic circumstances. Causation has become the most important explanation for socioeconomic inequalities in health, with the emphasis varying from material to behavioural and psychosocial explanations (Laaksonen M et al. 2005b, Macintyre 1997, Stronks et al. 1996, Thrane 2006). The material or structural explanation refers to inequalities in material resources being mainly responsible for the production of socioeconomic inequalities in health. People with more advantaged socioeconomic circumstances can for example afford better housing, better health care, and are likely to have less health risks in their working and living environment. Sometimes the social environment is also added to this category of explanations, with people in higher socioeconomic positions having better social support and relationships, and being more integrated into the community (Thrane 2006).

From the viewpoint of the behavioural or lifestyle explanation, socioeconomic differences in health behaviours including smoking, alcohol consumption, physical activity and dietary habits are the main explanation for the subsequent health inequalities. It should be noted that the two explanation models or pathways between socioeconomic circumstances and health, the material/structural and the behavioural/lifestyle explanations, are interrelated and overlapping. Material factors may to some degree determine the possibilities for practising favourable health-related behaviours such as physical activity and healthy food choices, while for example smoking and heavy drinking can be coping strategies in disadvantaged material circumstances (Blane et al. 1997, Sacker et al. 2001). However, the two explanations have been shown to be mostly independent (Laaksonen M et al. 2005b).

Particularly the material explanation model has been debated, and further suggestions about the possible explanation mechanisms have been made, such as the psychosocial explanation model (Elstad 1998, Macintyre 1997). The psychosocial explanation includes psychological stress, which varies according to socioeconomic circumstances and is caused by acute and chronic stressors that are unevenly distributed in the society. Psychosocial explanations can also include non-material

aspects of social support, networks, and relationships as well as working conditions (Elstad 1998, Martikainen et al. 2002, Pearlin 1989).

*Specific explanations: health behaviours, living arrangements and work-family conflicts*

Health behaviours represent the behavioural explanation or mechanism. Health behaviours can be distributed unequally according to the socioeconomic circumstances, socioeconomic disadvantage being generally associated with more health damaging behaviours. Therefore, health behaviours can partly explain the socioeconomic inequalities in health. The most commonly inspected behaviours are smoking, alcohol consumption, physical activity and dietary habits. Often also obesity, although technically not a behaviour itself, is used to reflect the relation between physical activity and diet. Various health behaviours are both independent and interrelated, and smoking has been suggested as a key behaviour determining other behaviours (Laaksonen M et al. 2005 b&c). Health behaviours are to a large part developed relatively early in the lifecourse, during adolescence and early adulthood (McCracken et al. 2007). They are partly individual choices, being influenced by the knowledge, beliefs and attitudes of the individual. However, as they are related to the socioeconomic circumstances of the individual and develop and occur in specific social contexts, they cannot be seen as only individual choices. Because of their time of development, particularly important social and socioeconomic environments are those of the time period from childhood to early adulthood. (Lynch et al. 1997)

Living arrangements can include the following circumstances: living alone, living with a spouse or partner, living with a spouse or a partner and children, living alone with children, and living with other adults such as one's parent(s) or friend(s). The measure can further differentiate between married and cohabiting or divorced, never-married, and widowed persons, but does not necessarily always do so. However, living arrangements can provide an overall more accurate picture of the current living circumstances and the related social ties than the measure of only official marital status, covering the composition of the family more extensively (Joutsenniemi et al. 2006). Living arrangements can be partly determined by socioeconomic circumstances (Koskinen & Martelin 1994, Fu & Goldman 1996) but they can also have an effect on, for example, household income. Living arrangements can affect health through a psychosocial mechanism by determining, for example, the availability of social support. People living alone are more likely to have lower levels of emotional and practical social support than married or cohabiting persons. Lack of social support

in turn is further associated with poorer health (Joutsenniemi et al. 2006, Ren 1997, Brown et al. 2005, Kotler & Wingard 1989). In addition, living arrangements may affect health through being related to health behaviours, living with a spouse providing support for healthier behavioural choices (Joutsenniemi et al 2007, Joung et al 1995), although it is also possible for a spouse to have a negative effect on health behaviours (Homish & Leonard 2005).

Work-family conflicts refer to the imbalance in the demands of work life and family life and the consequent conflicts and problems in and between these two areas of life. Work-family conflicts are essentially an interrole conflict in which the role demands of work life and family life, i.e. those of an employee, spouse and possibly a parent, are contrasting and conflicting (Greenhaus & Beutell 1985). For example, problems within a family can affect the concentration and performance at work, and long working time can in turn reduce the time available for the family. The direction of the conflict, i.e. whether it is the paid work that causes problems in family life or vice versa, has been considered to be important as the two types of conflict although interrelated are conceptually and empirically separate (Frone et al. 1992a, Grzywacz & Marks 2000). It has been suggested that family life would be more susceptible to the effects of work and its boundaries more permeable than the other way round, and thus work-to-family conflict would be more common than family-to-work conflict (Frone et al. 1992b).

Work-family conflicts belong to the line of psychosocial explanation mechanisms, and can be associated with health primarily through the related psychosocial stress (Lundberg & Frankenhäuser 1999). The onset and development of work-family conflicts may be partly determined by or related to factors such as socioeconomic circumstances and living arrangements. They can also to some degree reflect the prevailing working conditions and working time (Voydanoff 1988). Prevalence and consequences of work-family conflicts can vary between countries (Chandola et al. 2004), as well as between the sexes (Emslie et al. 2004, Grzywacz & Marks 2000, MacEwen & Barling 1994) with women sometimes reporting the interference of work on family more than men (Frone et al. 1992b). Work-family conflicts are not restricted only to families with children, for couples, single parents and single persons can also be affected (Grant-Vallone & Donaldson 2001).

## 2.4 International comparisons

Comparing groups and individuals with varying social backgrounds is essential in sociological research. The term 'comparative research' refers particularly to comparing larger units such as countries, nations and ethnic groups, i.e. to a study design in which data from for example different societies or cultures are collected and compared (Allardt 1990). For the comparative study of socioeconomic health inequalities in different countries, the motives consist of a variety of advantages. One of the main reasons why international comparisons are important is that they enable us to identify countries with larger and smaller inequalities. This further allows assessment of how particular social contexts and policies are related to and affect health, as these vary between countries (Martikainen et al. 2004, Arber & Lahelma 1993). Secondly, comparative studies make it possible to identify determinants of socioeconomic inequalities that are common in different countries, as well as those determinants that are unique to particular countries. This leads to a third advantage, which is that by comparing these determinants and the health inequalities in general between different societies, it is also possible to assess the limits of explanations of health inequalities obtained in one setting only. (Cavelaars et al. 1998, Martikainen et al. 2004.) Altogether, it can be concluded that international comparisons are needed since comparing different populations further contributes to the overall understanding of the multiple causes of health inequalities and the mechanisms related to them.

In international comparative studies it is essential to have comparable data from countries of which comparing is reasonable and meaningful. The countries compared in this study, Finland and Britain, are both affluent western European societies with developed welfare systems and a relatively similar standard of living. Thus, they should be socially and culturally similar enough so that comparing them is not overly complicated. Relative cultural similarity increases the likelihood of the survey questions being understood and responded to in a similar way, as the interpretation of the questions, the general attitude towards providing information on one's personal matters, and other orientations and tendencies related to responding can be dependent on the cultural background of the participant. Nevertheless, this can sometimes prove to be a challenge even when comparing national contexts seemingly close to each other (Allardt 1990).

There are also dissimilarities between the two countries, which makes the comparison more interesting and fruitful (Rahkonen et al. 2000, Arber & Lahelma 1993). First of all, the countries compared in this study represent different kinds of welfare state regimes: Finland represents the

'Nordic' or 'social democratic', Britain the 'liberal' regime (Esping-Andersen 1990, 1999). The regimes differ in their patterns of welfare provision and allocation as well as labour markets, social structure and the family, which are likely to contribute to the socioeconomic inequalities in health. The social democratic regime is characterized for example by universal welfare benefits and an equality-promoting redistributive social security system. The liberal regime in turn means minimal welfare and social security provided by the state. Therefore, differences exist in the labour markets particularly in women's full-time participation which is clearly higher in Finland. This in turn is related to how childcare and parental leaves are organized and subsidized within the differing welfare systems (Arber & Lahelma 1993, Rahkonen et al. 2000). Welfare regimes are also reflected in the differential income distributions: Finland has substantially smaller income inequalities than Britain (Gottschlak & Schmeeding 1997). However, also in Finland income inequality increased somewhat due to the labour market crisis in the 1990s, i.e. the decade preceding the collection of the data used in this study, but still remained substantially smaller than in Britain (Rahkonen et al. 2000, Gottschlak & Smeeding 1997). Other dissimilarities between the two countries exist for example in the social and economic history of the countries as Finland's development from a rural society into an industrial one happened much later than that of Britain. Rapid social and economic transformation and economic growth took place in Finland only after the World War II, and by 1990s Finland had reached Britain's level of per capita gross domestic product (GDP) (International Monetary Fund 2009). At the same time Britain had already had a long history as an affluent industrial society and was stable in terms of its social structure. In Finland, the expanding public sector recruited employees from rural settings, and the related upward social mobility may have caused the Finnish employee cohort of this study to have a less homogenous and more rural background (Rahkonen et al. 1997). Thus, the origins of the white-collar employees within the cohorts may vary, and could also influence the class composition to some degree.

Finally, it should be noted when discussing international comparisons, that the possible problems and other issues related to comparing two or more national contexts are also affected by other characteristics of the populations being analysed. For example, comparing particular focused employee and age groups of course differs from comparing general populations. The shared specific characteristics, such as the white-collar public sector employee positions in the cohorts of this study, might to some extent reduce the significance of the national backgrounds.

# 3 REVIEW OF THE LITERATURE

## 3.1 Multiple socioeconomic circumstances and health

There is a vast amount of evidence on the associations between socioeconomic circumstances and different domains of health. The background of the studies on health inequalities is in two research traditions: sociological studies and theories on social class and the socio-medical research tradition that has focused on the poor health of the poor people and lower classes and utilized the class theories in the studies on health differences (Lynch & Kaplan 2000, Macintyre 1997). However, although the beginnings of the early research on health and social class date back to the 19th century, it was not until the late 20th century that a more widespread interest in socioeconomic inequalities in health emerged. The expansion of the interest in socioeconomic inequalities in health in the last three decades was much influenced by the Black Report published in Britain in the early 1980s, which by reviewing the studies made thus far revealed that inequalities in mortality and morbidity still existed or in some cases even increased despite the overall improvement in health in Britain (Townsend & Davidson 1982).

Since the Black Report, a huge number of studies have documented inequalities in various domains of health, using a variety of socioeconomic indicators. For the most part, the studies preceding and following the Black Report provided largely descriptive evidence on socioeconomic inequalities in different health outcomes and mortality, considering only the general explanation types of social causation and selection (Macintyre 1997). The socioeconomic indicators used varied, but occupational class was most commonly applied in the British studies, whereas in the US education was more often used (Dahl 1994, Liberatos et al. 1988, Ross & Wu 1995). Overall, studies were often restricted to analysing only one or a few indicators at a time, using them as interchangeable, or trying to find the most important indicator among many (Lahelma et al. 2004).

Later on, explanatory studies testing and suggesting more specific explanations have been conducted, and there has also been an increasing focus on and inclusion of the multiple dimensions of socioeconomic circumstances. However, many studies have used two or more socioeconomic indicators simultaneously without the use of multiple indicators being a particular focus, and with the variety of the indicators often being limited to the more conventional ones only (e.g. Mackenbach et al. 1997 & 2008). Studies particularly emphasizing the analysis of multiple socioeconomic circumstances have most commonly included education, occupational class and

income (e.g. Araya et al. 2003, Lahelma et al. 2004, Rahkonen et al. 2000, Singh-Manoux et al. 2002), but also childhood circumstances (e.g. Harper et al. 2002, Rahkonen et al. 1997) and material circumstances including wealth (e.g. Laaksonen M et al. 2005b, Martikainen et al. 2003). In some of the studies on multiple socioeconomic circumstances, an important aspect has been the underlining of the lifecourse idea (e.g. Harper et al. 2002, Kahn & Pearlin 2006, Singh-Manoux et al. 2005).

In this review, evidence from studies using both multiple and single socioeconomic indicators are taken into account, as the number of multiple indicator analyses is still limited. Also, with regard to socioeconomic inequalities in physical functioning, studies using other physical and general health outcomes are also included, as there are not enough analyses on only physical functioning to cover the large variety of socioeconomic circumstances.

*Physical health and functioning*

In the physical domain of health, studies considering multiple socioeconomic circumstances have been conducted in various countries, including either only adult socioeconomic circumstances or also those of the early life. In the Helsinki Health Study employee cohort, education, occupational class and income were associated with limiting long-standing illness and self-rated health when analysed independently, but a simultaneous analysis revealed the effects of education to be mediated through occupational class and income (Lahelma et al. 2004). Another study showed also childhood socioeconomic circumstances and adult material circumstances to be associated with physical functioning, childhood circumstances affecting health through adult education, occupational class and income (Laaksonen M et al. 2007). Childhood socioeconomic circumstances have also been examined along with adult socioeconomic circumstances in the Finnish general population and shown to be associated with limiting long-standing illness and self-rated health (Rahkonen et al. 1997). In a Norwegian study, of occupational class, education and income, occupational class was most consistently associated with various outcomes of ill-health such as long-standing somatic illness (Dahl 1994). A US study documented material circumstances such as wealth along with income to be more important determinants of mortality than education and occupational class (Duncan et al. 2002). An international comparison using education, occupational class and income showed these indicators to be similarly associated with morbidity and mortality (Mackenbach et al. 1997).

In the studies using only one or a couple of socioeconomic indicators, the conventional indicators i.e. education, occupational class and income have been the ones most commonly inspected. In the British Whitehall II civil servant cohort, lower occupational class has been associated with poorer physical functioning (Hemingway et al. 1997, Martikainen et al. 1999) and lower household and personal income as well as household wealth with poor self-rated health (Martikainen et al. 2003). In the Helsinki Health Study, occupational class has been shown to be associated with physical functioning, self-rated health and limiting long-standing illness among other physical health outcomes (Lahelma et al. 2005). Across the European countries as well as in the US, lower education has been consistently associated with mortality (Feldman et al. 1989, Guralnik et al. 1993, Huisman et al. 2005, Mackenbach et al. 2003). In many countries, the educational differences in mortality have increased from the 1970s until the 1990s (Mackenbach et al. 2003). Similarly, educational differences have been widely documented for physical health outcomes including chronic conditions, limiting long-standing illness and self-rated general health (Cavelaars et al. 1998, Eikemo et al. 2008, Huisman et al. 2003, Kunst et al. 2005, Lahelma et al. 2002, Mackenbach et al. 1997 & 2008, Silventoinen et al. 2002). Across Europe, lower occupational class and income have also been associated with, for example, poorer physical functioning and self-rated health as well as limiting long-standing illness and mortality (Aittomäki et al. 2008, Kunst et al. 1998, Kunst et al. 2005, Lahelma et al. 2000, Lahelma et al. 2002, Mackenbach et al. 1997 & 2008, Martikainen et al. 1999, Sacker et al. 2001).

Housing tenure has sometimes been included along with education, occupational class or income, or also as the main focus of the study. A Finnish register-based study has shown renters to have a higher mortality than owner-occupiers, even when adjusting for education, occupational class and income (Laaksonen M et al. 2008). A British study found housing tenure along with income to be more strongly associated with mortality than occupational class (Chandola 2000). These results suggest that housing tenure may reflect material circumstances and wealth that are not fully captured by the conventional socioeconomic indicators. In Britain, renting has also been shown to be associated with more common limiting long-standing illness, self-rated general health and a number of symptoms (Macintyre et al. 2003).

Economic difficulties have been examined less than other socioeconomic circumstances. In the Whitehall II cohort, economic difficulties have been documented to be strongly associated with coronary events in men independently of other socioeconomic circumstances (Ferrie et al. 2005). A

study conducted in the United States among adults aged 65 and over documented an association between economic difficulties and physical symptoms, with the effect of early life economic difficulties being mediated by those experienced in middle life (Pudrovska et al. 2005). Other US studies have shown financial strain measured by debt/income ratio to be associated with lowered physical functioning as well as self-reported health (Drentea & Lavrakas 2000), and throughout the lifecourse accumulated financial strain to be associated with later life health including self-rated health, chronic conditions, and physical and mental symptoms (Kahn & Pearlin 2006).

*Common mental disorders*

Socioeconomic circumstances are associated with common mental disorders, but these associations have varied more than those observed for the physical domain of health and for more severe mental illnesses (Cheng et al. 2002, Fryers et al. 2003, Hemingway et al. 1997, Lahelma et al. 2006, Lewis et al. 1998, Martikainen et al. 1999, Stansfeld & Marmot 1992, Stansfeld et al. 1998). A number of studies have found common mental disorders to be more common among people belonging to lower socioeconomic groups, similarly to physical health in general. The evidence from studies on multiple socioeconomic circumstances shows particularly the importance of material circumstances and economic difficulties. A study on the Helsinki Health Study cohort demonstrated past and present economic difficulties to be strongly associated with common mental disorders when conventional indicators were adjusted for (Lahelma et al. 2006). A British study showed that a lower standard of living i.e. not having access to a car and renting a home were more strongly associated with neurotic disorder than lower education or occupational social class (Lewis et al. 1998). Results from another longitudinal British study further highlight the importance of material resources (Skapinakis et al. 2006). The study found financial difficulties to be associated with an increased risk of common mental disorders in a follow-up, while this was not the case for education and occupational social class. A US study showed financial strain measured by debts-to-assets ratio to be associated with depressive symptoms independently of income (Zimmerman & Katon 2005). Also in a study among elderly persons in Hong Kong self-rated financial sufficiency was associated with common mental disorders while education was not (Cheng et al. 2002). Other studies have also documented an association between economic difficulties and common mental disorders (Mirowsky & Ross 2001, Ross & Mirowsky 1999), with both early life and current economic difficulties being associated with later life depressive symptoms regardless of the level of income (Pudrovska et al. 2005).

In addition, there are results from multiple indicator studies including mainly the conventional measures of socioeconomic circumstances, i.e. education, occupational class and income. In a study among Finnish men, lower occupation class and income, but not parental socioeconomic position, were associated with adult depressive symptoms (Harper et al. 2002). A Turkish study found a lower occupational social class, education, and income to be associated with more frequent common mental disorders measured by the GHQ-12 (Belek 2000). The occupational social class differences were not explained by education or income. Also studies using only one or a couple of socioeconomic measures have shown conventional indicators of socioeconomic circumstances i.e. education, occupational class and income to be associated with common mental disorders. Among British civil servants in the Whitehall II Study, occupational class has been associated with declined mental functioning (SF-36), depressive symptoms (GHQ subscale) and general mental health among men (Martikainen et al. 1999, Stansfeld et al. 1998, Hemingway 1997 et al.). In addition, household and personal income as well as household wealth were associated with depressive symptoms among the civil servants (Martikainen et al. 2003).

In contrast to the studies documenting more frequent common mental disorders among lower socioeconomic groups, there have also been studies which have observed that the associations can be negligible or even somewhat reverse, with people in higher socioeconomic positions reporting disorders more frequently. A study on the British general population showed negligible associations of occupational social class, general social advantage and income with common mental disorders (GHQ-12) (Wiggins et al. 2004). The above-mentioned studies on the Whitehall II cohort did not find occupational class to be associated with various mental health outcomes among women (Martikainen et al. 1999, Hemingway et al. 1997), and when using GHQ, a reverse association between occupational class and common mental disorders was observed in women (Stansfeld & Marmot 1992, Stansfeld et al. 1998). Previous analyses of the Helsinki Health Study cohort have also shown slight reverse associations, i.e. common mental disorders being somewhat more common in the higher occupational groups in both women and men (Lahelma et al. 2005, Lahelma et al. 2006).

The varying results obtained for the associations of socioeconomic circumstances with common mental disorders may be related to a range of factors. Particularly, the chosen measures of socioeconomic circumstances might affect the results, many studies having found stronger and clearer gradients for certain socioeconomic indicators than for others, as seen also above (Lahelma

et al. 2006, Fryers et al. 2003). There have been tendencies for lower income and particularly financial difficulties and material standard of living rather than lower occupational class or education to be more consistently associated with common mental disorders (Fryers et al. 2003, Lewis et al. 1998). These observations point out the importance of assessing the effects of multiple dimensions of socioeconomic circumstances as using only one indicator might give a flawed picture of the associations between the complex entity of socioeconomic circumstances and health. Also the way of measuring common mental disorders can have an effect on the observed associations. The indicator used, the possible subdomain such as depressive or anxiety disorders, as well as the severity of the disorders studied, may all affect the results (Henderson et al. 1998, Miech et al. 1999). For example, a study on adolescents (Miech et al. 1999) found socioeconomic position to be associated with anxiety symptoms but not depressive symptoms, while another study found stronger associations for more severe common mental disorders (Henderson et al. 1998). Furthermore, the results have varied according to the population of the study, e.g. employees, the unemployed or the general population, (Lewis et al. 1998, Goodman & Huang 2001, Huurre et al. 2003, Wiggins et al. 2004), which is notable as the present study focuses on employees. Age, gender as well as the national and cultural context of the study population are also factors that can affect the associations found. (Araya et al. 2003, Belek 2000, Der et al. 1999, Lewis et al. 1998, Muntaner et al. 2003, Weich et al. 2004)

### 3.2 Explanations for socioeconomic inequalities in health: behavioural and social factors

*Behavioural factors*

Of the possible explanations for the associations between socioeconomic circumstances and health, different kinds of health behaviours have been widely recognized as being associated with a variety of health outcomes. Higher mortality, more common chronic diseases and overall poorer physical and mental health have been documented among heavy drinkers (Marmot et al. 1981, Poikolainen et al. 1996, San José et al. 2000, Strine et al. 2001), smokers (Ezzati & Lopez 2004, Laaksonen M et al. 2006, Rohrer et al. 2005, Strine et al. 2001, WHO 2002), as well as obese persons (Allison et al. 1999, Doll et al. 2000, Pi-Sunyer 1999, Rohrer et al. 2005, Strine et al. 2004). With smoking, an increase in consumption has been associated with even poorer health (Mulder et al. 2001, Wilson et al.), as has also the pattern of drinking and not only the amount of alcohol consumed (San Jose et al. 2000). Physical activity has been shown to contribute to better physical and mental health, with

even small amounts being beneficial (Lee 2007, Manson et al. 2002, Rohrer et al. 2005, Strine et al. 2004, Atlantis et al. 2004, Lawlor & Hopker 2001). In the Whitehall II cohort physical activity in mid-life has been found to be important for maintaining a high level of physical functioning in early old age (Hillsdon et al. 2005).

Health behaviours vary according to socioeconomic circumstances, and the association may be related to factors such as lack of knowledge and material resources and psychosocial stress (Stronks et al. 1997). Adult heath behaviours have also been suggested to partly develop in early stages of the life course, originating from early life socioeconomic circumstances through educational and occupational pathways (Lynch et al. 1997). First of all, a number of studies have observed socioeconomic differences in alcohol consumption (van Oers et al. 1999, Osler et al. 2001). Socioeconomic disadvantage across the lifecourse has been shown to be associated with less-healthy midlife drinking patterns (Caldwell et al. 2008, Lynch et al. 1997). Smoking has been documented to vary according to adulthood socioeconomic circumstances including education, occupational class, income and various aspects of material resources such as housing tenure, economic difficulties and economic satisfaction (Cavelaars et al. 2000, Laaksonen M et al. 2005c, Lynch et al. 1997, Power et al. 2005, Rahkonen et al. 2005, Stronks et al. 1997) as well as childhood and adolescent socioeconomic circumstances (Power et al. 2005, Jefferis et al. 2004, Graham et al. 1999, Lynch et al. 1997). Physical activity and obesity also vary according to socioeconomic circumstances, with adult socioeconomic circumstances such as lower education and occupational class being associated with less frequent physical activity (Ford et al. 1991, Lynch et al. 1997) and more common obesity (Laaksonen M et al. 2004, Lynch et al. 1997). An international comparison found socioeconomic disadvantage not only in adulthood but also in childhood to be associated with an increased risk of obesity in all of the six Western countries studied, including Finland and Britain (Power et al. 2005). A number of other studies have also observed associations between early life socioeconomic circumstances and obesity, even when adjusting for adult socioeconomic circumstances (Hardy et al. 2000, Laaksonen M et al. 2004, Langenberg et al. 2003, Parsons et al. 1999, Poulton et al. 2002).

*Social factors*

Social factors that can in addition to socioeconomic circumstances affect health include, for example, living arrangements and work-family conflicts, which are covered here. There is some

evidence, although somewhat inconsistent, that socioeconomic circumstances and living arrangements are associated. People with lower education have been shown in Finland to be less likely to be married (Koskinen & Martelin 1994) and in the US to cohabite (Bumpass & Sweet 1989, Brown 2004). However, higher education has also been documented to be associated with lower marriage rates in the US, as has lower income (Fu & Goldman 1996). Furthermore, another study showed financial problems to be more common among people entering cohabitation than those entering marriage (Horwitz & White 1998).

Living arrangements have been shown to be associated with mortality and morbidity independently of official marital status (Davis et al. 1992, Joung et al. 1995, Lund et al. 2002, Murphy et al. 1997). They have also been documented to be associated with common mental disorders with persons living alone reporting disorders more frequently than others (Aro et al. 2001, Harrison et al. 1999, Hughes & Waite 2002). In a study on the Finnish general population those living alone and with other people than a partner were twice as likely to report common mental disorders (Joutsenniemi et al. 2006). However, contrasting results have also been obtained for physical and mental health among women aged over 60 years. A US study showed that women living independently did not have an increased risk for decline in physical functioning measured by the SF-36, and their mental functioning was even better than that of those living with a spouse (Michael et al. 2001).

Associations between living arrangements and health can partly be due to persons living with a spouse or partner having more favourable health behaviours such as less smoking and drinking as well as better availability of social support than persons living alone or alone with children (Joutsenniemi et al. 2006 & 2007, Joung et al 1995, Rahkonen et al. 2005). It is also possible that living arrangements such as becoming a single parent affect socioeconomic circumstances, chiefly household income, housing tenure or economic difficulties, which in turn can affect health (Wickrama et al. 2006). Furthermore, health-related selection may take place i.e. those with poorer health ending up in certain living arrangements such as lone parenthood or living alone (Fu & Goldman 1996, Waldron et al. 1997), although evidence on selection is inconsistent.

For work-family conflicts, information on the associations with socioeconomic circumstances is limited, but a few studies provide evidence on the existing relatedness as they have included some socioeconomic measures while focusing on other determinants. Work-family conflicts, particularly work causing problems with the family, have been shown to be more common among people with higher education (Allen & Armstrong 2006, Grzywacz et al. 2002, Grzywacz & Marks 2000,

Kinnunen & Mauno 1998, Voydanoff 2004) as well as with higher income (Grzywacz & Marks 2000). Both work-to-family and family-to-work conflicts have been shown to be associated with different domains of health, persons with conflicts between the two areas of life reporting poorer health. This has been observed for various mental health outcomes and stress (Allen et al. 2000, Chandola et al. 2004, Frone 2000, Grzywacz 2000), self-rated general and physical health (Emslie et al. 2004, Grzywacz 2000, Winter et al. 2006) as well as chronic conditions (Grzywacz 2000). Work-family conflicts can affect health through stress processes but they have also been suggested to affect health through being related to health behaviours such as drinking patterns, smoking, physical activity and food habits (Lallukka et al. 2009, Roos et al. 2006, Allen & Armstrong 2006).

### 3.3 International comparisons of socioeconomic inequalities in health

From the international comparisons among European countries, two groups of studies that are of interest in this study can be identified. Firstly, there have been a fairly large number of analyses including data from several countries in Europe, mainly northern, western and to some degree southern Europe, including Finland and Britain. The second group consists of those comparisons more specifically concentrating on Britain and Finland. Many of the previous comparative studies have only focused on one dimension of socioeconomic circumstances at a time. The studies have also been mostly descriptive, and predominantly restricted to the physical domain of health.

The results from the extensive comparisons of multiple European countries are varying, some showing differences in the prevalence and magnitude of socioeconomic inequalities in physical health between the countries, but some of them documenting only small differences between countries. A recent study examined health inequalities by education in different welfare regimes by comparing 23 European countries (Eikemo et al. 2008). The study showed that in the Scandinavian welfare regimes the educational differences in limiting long-standing illness were larger and the prevalence of illness higher than in Anglo-Saxon regimes. However, in both of these welfare regimes, inequalities were smaller than in Southern Europe. A comparison of 11 Western European countries showed that the size of educational differences in self-reported morbidity varies between countries. However, the differences between Finland and Britain were small and both countries belonged to the group with ‘intermediate’ inequalities (Cavelaars et al. 1998). Another comparative study examining the trends in health inequalities showed that the inequalities in self-reported health by education and income were relatively stable in Finland and Britain among other European

countries in the 1980s and 1990s (Kunst et al. 2005), although educational and occupational class inequalities in mortality increased in that period both in Finland and in England/Wales among other countries (Mackenbach et al. 2003). In a comparison of multiple European countries, a similar occupational class gradient in ischaemic heart disease mortality was found in Finland and in Britain (Kunst et al. 1998).

The studies concentrating specifically on Finland and Britain have documented mainly only slight differences between the countries. For occupational class, largely similar patterning in physical functioning and perceived health has been observed as for education among public sector employees from Britain and Finland (Martikainen et al. 2004). However, other comparisons between Finland and Britain have found somewhat larger occupational class differences in limiting long-standing illness and self-perceived health among women in Finland than in Britain (Arber & Lahelma 1993, Lahelma et al. 2000). In contrast, slightly larger differences in self-perceived health by household income have been found among British women than Finnish, although the patterning was similar among men in the two countries (Rahkonen et al. 2000). Also housing tenure has been shown to be more important in terms of limiting long-standing illness among British than Finnish women (Arber & Lahelma 1993). Furthermore, a European comparison found only small differences between Finland and Britain in educational, occupational class and income inequalities in morbidity and mortality (Mackenbach et al. 1997).

The evidence from international comparisons on socioeconomic inequalities in common mental disorders or mental health in general is very limited. Previous international comparisons on mental disorders have mainly focused on the United States and Asian countries (Inaba et al. 2005, Krause et al. 1991). One study has compared common mental disorders and the effects of work-family conflicts between the Helsinki Health Study and the Whitehall II Study, and found Finnish men and women to have slightly fewer disorders measured with the SF-36 mental component score than British men and women (Chandola et al. 2004). Among Finnish women, the better mental health could to some degree be explained by their fewer work-family conflicts. There have been reviews on studies conducted in European countries, but these have not included Finland (Fryers et al. 2003 & 2005). However, according to these studies, the differences in the socioeconomic patterning of common mental disorders are likely to be fairly small between Britain and other countries.

### 3.4 Summary of the previous findings

Oveall, the previous studies provide clear evidence that socioeconomic inequalities in both physical and mental domains of health exist in different countries and that there is a range of factors which may explain these inequalities. However, the results on socioeconomic inequalities in health have differed according to the dimensions of the socioeconomic circumstances studied. A clear general view has not been obtained on associations between the multi-dimensional entity of socioeconomic circumstances and different domains of health. The main problem is that the studies have not extensively focused on the inclusion of multiple socioeconomic circumstances along the lifecourse. They have rather investigated one or only a few dimensions of the socioeconomic circumstances at a time, and those that have actually considered multiple circumstances have to a large extent concentrated on the conventional indicators, i.e. education, occupational class and income. This practice has naturally produced slightly differing results as the socioeconomic measures are not interchangeable (Braveman et al. 2005). However, those studies that have actually analysed multiple socioeconomic circumstances show that there are different kinds of pathways between the conventional dimensions, i.e. education, occupational class and income, as well as between childhood and adulthood socioeconomic circumstances (e.g. Lahelma et al. 2004, Laaksonen M. et al. 2007). These results warrant further analyses on multiple socioeconomic circumstances to further unravel the prevailing pathways and mechanisms.

Secondly, the previous results differ somewhat depending on the health outcomes inspected. For example, the socioeconomic patterning of common mental disorders does not correspond with that of physical health in general (e.g. Lahelma et al. 2006). Also, within the domains of health, using different kinds of health measures has provided slightly different results (Fryers et al. 2003). Thus, to be better able to assess the dissimilarities and similarities between the patterning of the different domains of health, in addition to the multiple socioeconomic circumstances, different kinds of health outcomes should also be inspected simultaneously or in highly similar study settings and designs.

Thirdly, international comparisons have produced results that in general have shown mainly small differences between Finland and Britain and other European countries (Martikainen et al. 2004, Rahkonen et al. 2000, Mackenbach et al. 1997 & 2003 & 2008, Kunst et al. 1998 & 2005). However, there have been limitations in this group of studies that could affect the overall picture of the existing country differences, as well as cause restrictions in utilizing the information in more

general interpretations. In the mental domain of health there is an overall lack of comparisons, and in the physical domain the comparisons made have not adequately examined multiple socioeconomic circumstances. Thus, studies simultaneously comparing multiple countries and including multiple socioeconomic circumstances as well as domains of health would produce new information and increase the understanding of the production mechanisms of socioeconomic inequalities in health.

Fourthly, further explanations for socioeconomic inequalities in different domains of health have been sought, and various general explanation mechanisms, the major ones being material, behavioural and psychosocial, have been suggested (Macintyre 1997, Stronks et al. 1996, Thrane 2006). More specific explanations such as health behaviours have been examined (Laaksonen M. et al. 2005a, Ferrie et al. 2005, Stronks et al. 1996). However, also in these efforts there has often been the deficiency of not adequately considering multiple circumstances and multiple populations simultaneously. Thus, on the basis of the previous results it cannot be clearly concluded whether the explanation mechanisms are similar for different dimensions of socioeconomic circumstances in different domains of health, as well as in different populations and national contexts.

## 4 AIMS OF THE STUDY

The general aim of this study was to examine the complex associations of multiple socioeconomic circumstances with physical and mental health by comparing public sector employee cohorts from Finland and Britain consisting of middle-aged women and men in white-collar positions. The socioeconomic circumstances examined were parental education, childhood economic difficulties, own education, occupational class, household income, housing tenure and current economic difficulties. The mechanisms of the associations of childhood and current economic difficulties with health were also tackled by examining the effects of possible explanatory factors, i.e. health behaviours, living arrangements and work-family conflicts.

The two specific aims of the study were:

1. To examine the associations of multiple socioeconomic circumstances with physical functioning and common mental disorders and to compare these associations between the two country-specific cohorts. (Sub-studies I and II)
2. To examine whether the associations of childhood and current economic difficulties with physical functioning and the associations of current economic difficulties with common mental disorders can be explained by health behaviours, living arrangements or work-family conflicts. (Sub-studies III and IV)

# 5 DATA AND METHODS

## 5.1 Data sources

Data from surveys conducted among middle-aged public sector employees in Finland and Britain were used in all four sub-studies. The Finnish Helsinki Health Study data collection largely followed the protocol of the British Whitehall II Study, and the data sets were further harmonized as described below. Data from the two countries were thus highly comparable with regard both to the question forming and the characteristics of the participants.

*The Helsinki Health Study*

The Helsinki Health Study is a longitudinal prospective cohort study of male and female employees of the City of Helsinki, the capital of Finland. Data from the baseline surveys conducted in 2000, 2001 and 2002 were used in this study. In the baseline, each year a questionnaire was posted to employees reaching the age of 40, 45, 50, 55 and 60 years (N=8960, response rate 67%; 80% of respondents were women) (Lahelma et al. 2005). For the third and the fourth sub-study, data from years 2001 and 2002 were only used, as information on work-family conflicts was lacking in the year 2000 data.

*The Whitehall II Study*

The Whitehall II Study is a longitudinal prospective cohort study of male and female civil servants aged 35-55 years at the time of recruitment, working in the London offices of twenty National Government Civil Service departments. The study includes data from seven postal surveys and four screening examinations conducted in years 1985-2004 (baseline N=10308, response rate 73%). (Marmot & Brunner 2005, Marmot et al. 1991) Data from the postal survey at phase 5 (1997-99) were mainly used in this study (N=7830, response rate 76%; 28% of respondents were women). For certain socioeconomic variables information from phase 1 or 3 was used if phase 5 information was missing.

*Harmonization of the cohorts*

To make the cohorts maximally comparable, data were further harmonized with the following inclusions and exclusions. Firstly, respondents aged 45-60 years from both cohorts were included in all four sub-studies. Thus the youngest age-group from the Helsinki cohort and the oldest from the London cohort were excluded. Secondly, manual workers were excluded from the Helsinki cohort and those not working in the Civil Service anymore were excluded from the London cohort. The final number of participants included in the analyses, i.e. those with information on the outcome, differed slightly according to the outcome used. The numbers of participants in the sub-studies are presented in Table 1. The basic characteristics of the participants are shown in Appendix table 1.

Table 1 Number of participants (N) in sub-studies I-IV

| | Sub-studies I & III* | Sub-studies II & IV** |
|---|---|---|
| | N | N |
| **Helsinki Health Study** | | |
| Women | 4807 | 4949 |
| Men | 1059 | 1079 |
| All | 5866 | 6028 |
| | | |
| **Whitehall II Study** | | |
| Women | 847 | 875 |
| Men | 2205 | 2241 |
| All | 3052 | 3116 |

* SF-36 PCS as the health outcome

** GHQ-12 as the health outcome

## 5.2 Measures

*Measurements of health*

Physical functioning was measured with the physical component summary (PCS) of the Short Form 36 (SF-36) questionnaire (Ware et al. 1994, Ware & Kosinski 2001). The SF-36 questionnaire consists of 36 items coded into eight scales: general health perceptions, physical functioning, role limitations due to physical functioning, bodily pain, general mental health, role limitations due to emotional problems, vitality, and social functioning. These scales summarize into physical and mental functioning component summaries by a method based on factor analysis. The scoring varies from 0 to 100, with lower scores implying poorer functioning. In this study, the lowest quartile of the PCS for each sex and cohort was used to indicate poor physical functioning. The cut-off was 47.3 (men) and 44.2 (women) in Helsinki, and 50.1 (men) and 46.4 (women) in London. The SF-36 questionnaire has been shown to have good construct validity, internal consistency, as well as test-retest reliability (Brazier et al. 1992, Ware et al. 1993 & 1994).

Common mental disorders were measured by the 12-item version of the General Health Questionnaire (GHQ-12). The GHQ measures disorders that are recent, general, non-psychotic, and context-free, i.e. not related to a specific context such as work or family (Goldberg 1972, Goldberg et al. 1997, Warr 1987). The Helsinki Health Study data included the 12-item version while for the Whitehall II Study data the 12-item version was extracted from the 30-item version. Comparisons of the different versions of the GHQ have proved them to be equally valid (Goldberg et al. 1997). A control analysis was performed with the GHQ-30 in the Whitehall II data on the associations between socioeconomic circumstances and common mental disorders, and the results were identical with those obtained with the GHQ-12. Results produced by the GHQ are also likely to be comparable between countries and the validity not affected by the language of the questionnaire (Goldberg et al. 1997). The GHQ-12 gives a total score ranging from 0 to 12. A recommended and commonly used cut-off point of three or more symptoms was used in this study to indicate common mental disorders (Goldberg 1972, Goldberg et al. 1997, Makowska et al. 2002).

*Measurements of socioeconomic circumstances*

The seven socioeconomic measures included in all sub-studies were parental education, childhood economic difficulties, own education, occupational class, household income, housing tenure and current economic difficulties. Parental education was based on information about parents' educational level in the Helsinki cohort and parents' age on leaving full-time education in the London cohort. In both cohorts parental education was based on information about both mother's and father's education of which the higher one was chosen. Three groups were formed: (1) higher education, i.e. matriculation or college examination or more (Helsinki) and leaving full-time education at the age of 18 or over (London); (2) intermediate education, i.e. secondary school or vocational training (Helsinki) and leaving full-time education at the ages of 16-17 (London); and (3) basic education, i.e. primary school or less (Helsinki) cohort and leaving full-time education at the age of 15 or below (London).

Childhood economic difficulties were measured by asking whether the respondent's childhood family had faced serious (Helsinki) or continuing (London) financial problems before the respondent was aged 16. The response categories were 'yes' and 'no'. Own education was divided into three levels: (1) higher education, i.e. university degree; (2) intermediate education, i.e. matriculation or college examination (Helsinki) and A/S level or ONC/HND qualifications (London); and (3) basic education, i.e. secondary or vocational school (Helsinki) and no academic qualification or O-level (London).

Occupational class was divided into three hierarchical categories according to a classification used in an earlier comparative study (Martikainen et al. 2004): (1) administrative and managerial, (2) professional and semi-professional, and (3) clerical employees. In the Helsinki cohort occupational class mainly derived from the personnel register data of the City of Helsinki (80%) and was completed from the questionnaire data. The highest class consisted of managers in supervisory positions, the second highest of professionals (e.g. teachers, social workers and medical doctors) and semi-professionals (e.g. nurses, foremen and technicians), and the third class included clerical employees and other non-professional occupations. In the London cohort the categorization was based on the questionnaire data by collapsing the 12 non-industrial salary-based grade levels. The highest class consisted of unified grades 1-6 (Permanent Secretary to Senior Principal), the second highest class included unified grade 7 (Principal), senior and higher executive officers and executive officers, and the third class consisted of clerical officers and clerical assistants.

In the London cohort household income was based on the total income the respondent's household had received during the last 12 months, and in Helsinki on the total household income during a typical month. Household income was equalized by dividing the income by the household size, which was weighted according to the modified OECD equivalence scale: the respondent received the value of 1.0, other adults 0.5 and children 0.3 (Hagenaars et al. 1994). For both cohorts four income groups were formed each consisting of approximately a quarter of the combined population of men and women in each cohort.

Housing tenure was dichotomized into owner-occupiers and renters. Current economic difficulties were measured with two questions: (1) "How much difficulty do you have in meeting the payment of bills?" and (2) "How often does it happen that you do not have enough money to afford the kind of food or clothing you/your family should have?" in London, and "How often do you have enough money to buy the food or clothing you or your family need?" in Helsinki. For these questions there were five response alternatives indicating the level of difficulties. The sum scores for the two variables were then divided into three degrees of economic difficulties: (1) no difficulties, (2) occasional difficulties and (3) frequent difficulties.

Correlations between the socioeconomic circumstances were calculated as there is a possibility of multicollinearity, although an earlier analysis of multicollinearity of the indicators used in this study showed acceptable values (Laaksonen M et al. 2005). Correlations were positive in both cohorts ranging from r=0.003 to r=0.61, the highest ones being between own education and occupational class in Helsinki (r=0.61) and between household income and occupational class in London (r=0.53). Thus, the indicators share both common and specific characteristics of socioeconomic circumstances. The assumed interrelations between the socioeconomic circumstances are illustrated in Figure 1.

*Measurements of health behaviours*

Four measures of health behaviours were used. Smoking was divided into two categories: current smokers and non-smokers. Alcohol consumption was based on reported units of alcoholic beverages consumed during an average week (Helsinki) or the previous week (London). Units were converted into grams. Consumption exceeding 280 grams/week among men and 140 grams/week

among women was considered as heavy drinking. The measure of physical activity was combined from questions asking about weekly and monthly frequency of physical activity on different levels of strenuousness. The least active quintile was classified as inactive. Body mass index (BMI) (weight/height$^2$) was calculated from self-reported (Helsinki) or measured (London) height and weight, and obesity was classified as BMI of 30 or higher.

*Measurements of living arrangements and work-family conflicts*

Living arrangements were categorized into five groups: living alone, living with spouse/partner, living alone with children (0-18 years), living with spouse/partner and children, and others i.e. those living with other adults including adult children.

Work-to-family and family-to-work conflicts were measured with four items each (Grzywacz et al. 2000). The work-to-family question was: "To what extent do your job responsibilities interfere with your family life?" The response statements were: (1) "Your job reduces the amount of time you can spend with the family", (2) "Problems at work make you irritable at home", (3) "Your work involves a lot of travel away from home", and (4) "Your job takes so much energy you do not feel up to doing things that need attention at home". The family-to-work question was: "To what extent does your family life and family responsibilities interfere with your performance on your job in any of the following ways?" The response statements were: (1) "Family matters reduce the time you can devote to your job", (2) "Family worries or problems distract you from your work", (3) "Family activities stop you getting the amount of sleep you need to do your job well", (4) "Family obligations reduce the time you need to relax or be yourself". For each item, there were four response categories: 'not at all', 'to some extent', 'a great deal', 'not applicable'/'I don't have a family'. The responses were summed to form separate scales from 4 to 12 for work-to-family and family-to-work conflict. The sum scores were grouped into three categories, i.e. 'low' (4), 'average' (5-7) and 'high' (8+) conflicts. Those who responded 'not applicable'/I don't have a family' to any of the items formed the fourth category.

### 5.3 Statistical methods

Age-adjusted prevalence percentages of the health outcomes with 95% confidence intervals (CI) were calculated by the socioeconomic variables (all four sub-studies) and also by explanatory variables (sub-studies III and IV). Logistic regression analysis was used to examine the associations of the socioeconomic circumstances with poor physical functioning (sub-study I) and common mental disorders (sub-study II). Firstly, age-adjusted bivariate models for each indicator of socioeconomic circumstances were calculated. In the following multivariate models the indicators of socioeconomic circumstances were added in an assumed temporal order: first, childhood circumstances; next, the conventional indicators of adult socioeconomic circumstances; and finally, all seven indicators of socioeconomic circumstances simultaneously. Interactions of childhood and current economic difficulties with each other and with household income were also tested. The results are presented as odds ratios (OR) and their 95% CI. In this summary, the results from sub-studies I and II are presented only for the age-adjusted and the fully adjusted models as the changes between the multiple models were generally small.

To study the associations between childhood and current economic difficulties and poor physical functioning, relative indices of inequality (RII) were calculated separately for each cohort and sex (sub-study III). The relative index of inequality is the relative increase in poor physical functioning from the lowest to the highest score of current and childhood economic difficulties obtained from logistic regression models (Mackenbach & Kunst 1997). Age-adjusted relative indices of inequality with 95% CI were calculated first (model 0). In models 1 and 2, further socioeconomic circumstances were adjusted for. When analysing the association between childhood economic difficulties and physical functioning, parental education, own education, occupational class, income and housing tenure were first adjusted for (model 1) and after that current economic difficulties were added (model 2). When analysing the association between current economic difficulties and physical functioning, childhood difficulties were adjusted for before the other socioeconomic variables. In the subsequent models, health behaviours (model 3), living arrangements (model 4), and work-family conflicts (model 5) were further adjusted for.

To study the associations between current economic difficulties and common mental disorders, inequality indices with 95% CI for common mental disorders were calculated with logistic regression analysis using economic difficulties as a continuous variable (sub-study IV). The inequality index is interpreted as the average change in ill-health (in terms of the odds ratio) for

each step up in the level of economic difficulties. Age-adjusted indices were first calculated. In the subsequent multivariate models the socioeconomic variables were first adjusted for. After this, living arrangements, health behaviours and work-family conflicts were added, one variable group at a time. In the final model all variables were simultaneously adjusted for. Interactions of household income and work-to-family as well as family-to-work conflicts with current economic difficulties were also examined.

Missing values were more common in the London cohort than in the Helsinki cohort. The largest proportion of missing values in London was in the variable of household income, in which it was 13% among men and 15% among women. It was possible to replace some missing values with information from other phases, or with the help of other questions such as using personal income instead of household income for those living alone, which allowed approximately half of the missing values to be replaced. To further address the issue of item missing, multiple imputation using the ICE (Imputation by Chained Equations) method in STATA was applied (Royston 2004). Five copies of the data were formed in the process, each with missing values imputed on the basis of the variables used in the study in question. These copies were independently analysed and estimates of parameters were averaged across the copies to obtain a mean estimate and 95% CI. The results were in line with those obtained with a complete case analysis, but the precision of the estimations was improved.

# 6 RESULTS

The following results section presents the main results from the four sub-studies. Results for the Helsinki and the London cohort as well as for women and men are presented separately one after the other, first for physical functioning and then common mental disorders. Results for the further explanatory factors are presented after the base results on socioeconomic circumstances. The basic characteristics of the participants are shown in Appendix.

## 6.1 Associations of multiple socioeconomic circumstances with health (Sub-studies I and II)

*Physical functioning*

The first sub-study focused on the associations between socioeconomic circumstances and physical functioning. In Helsinki, the percentage of men and women reporting poor physical functioning was higher in lower status groups by all seven socioeconomic circumstances (Table 2). These prevalence percentages were confirmed by the age-adjusted logistic regression models (Table 3, base models). However, all associations were not statistically significant among men. Among women, when adjusting for all of the socioeconomic circumstances simultaneously, the association of childhood and current economic difficulties and own education with physical functioning remained (Table 3, final model). The associations of parental education, occupational class and household income with physical functioning were attenuated particularly when own education was adjusted for (data not shown). Among men, after adjustments for all socioeconomic circumstances, all associations weakened (Table 3, final model). Only childhood economic difficulties and own education showed statistically significant associations with poor physical functioning, although quite clear differences in the estimates could be observed also for current economic difficulties. Adjusting for own education affected the differences by occupational class and household income (data not shown). No statistically significant interactions were found. Overall, the results were highly similar for women and men.

Table 2 Age-adjusted prevalence of poor physical functioning and common mental disorders by the study variables (%).

| | Helsinki women | | Helsinki men | | London women | | London men | |
|---|---|---|---|---|---|---|---|---|
| | Physical % | Mental % | Physical % | Mental % | Physical % | Mental % | Physical % | Mental % |
| **Parental education** | | | | | | | | |
| Higher | 20 | 30 | 27 | 23 | 25 | 30 | 24 | 25 |
| Intermediate | 25 | 26 | 20 | 21 | 16 | 30 | 24 | 22 |
| Basic | 27 | 26 | 26 | 24 | 27 | 28 | 26 | 23 |
| **Childhood economic difficulties** | | | | | | | | |
| No difficulties | 23 | 25 | 24 | 21 | 23 | 27 | 23 | 21 |
| Difficulties | 34 | 36 | 30 | 31 | 29 | 36 | 31 | 31 |
| **Own education** | | | | | | | | |
| Higher | 17 | 27 | 22 | 23 | 22 | 32 | 24 | 23 |
| Intermediate | 25 | 29 | 23 | 22 | 32 | 30 | 24 | 24 |
| Basic | 31 | 25 | 33 | 23 | 24 | 29 | 29 | 24 |
| **Occupational class** | | | | | | | | |
| Administrative/managerial | 15 | 28 | 19 | 23 | 16 | 28 | 23 | 22 |
| Professional/semi-professional | 21 | 27 | 27 | 23 | 26 | 33 | 27 | 25 |
| Clerical | 30 | 26 | 32 | 18 | 30 | 23 | 28 | 16 |
| **Household income** | | | | | | | | |
| Highest group | 20 | 23 | 23 | 24 | 19 | 28 | 22 | 23 |
| 2nd | 25 | 26 | 19 | 23 | 19 | 27 | 23 | 25 |
| 3rd | 26 | 27 | 29 | 21 | 28 | 29 | 28 | 23 |
| Lowest group | 30 | 29 | 32 | 25 | 30 | 31 | 27 | 24 |
| **Housing tenure** | | | | | | | | |
| Owner-occupier | 23 | 26 | 24 | 22 | 24 | 30 | 25 | 23 |
| Renter | 29 | 27 | 30 | 25 | 28 | 20 | 31 | 24 |
| **Current economic difficulties** | | | | | | | | |
| No difficulties | 22 | 22 | 24 | 20 | 20 | 26 | 22 | 20 |
| Occasional difficulties | 27 | 30 | 28 | 26 | 29 | 32 | 28 | 26 |
| Frequent difficulties | 35 | 45 | 34 | 33 | 37 | 36 | 33 | 36 |
| **Living arrangements** | | | | | | | | |
| Alone | 27 | 29 | 32 | 26 | 21 | 49 | 23 | 23 |
| With spouse/partner | 26 | 24 | 22 | 23 | 26 | 39 | 21 | 22 |
| Alone with children | 23 | 33 | 21 | 32 | 27 | 14 | 22 | 24 |
| With spouse/partner and children | 21 | 24 | 22 | 19 | 25 | 25 | 26 | 23 |
| Other | 25 | 28 | 22 | 25 | 25 | 45 | 28 | 25 |
| **Current smoking** | | | | | | | | |
| No | 25 | 26 | 24 | 20 | 25 | 29 | 24 | 23 |
| Yes | 25 | 31 | 28 | 30 | 27 | 29 | 30 | 24 |
| **Heavy drinking** | | | | | | | | |
| No | 25 | 26 | 26 | 23 | 26 | 28 | 25 | 23 |
| Yes | 25 | 32 | 11 | 22 | 16 | 35 | 27 | 24 |
| **Physical inactivity** | | | | | | | | |
| No | 23 | 26 | 22 | 20 | 23 | 29 | 25 | 23 |
| Yes | 32 | 30 | 36 | 31 | 33 | 29 | 25 | 24 |
| **Obesity** | | | | | | | | |
| No | 22 | 26 | 23 | 22 | 24 | 29 | 23 | 23 |
| Yes | 42 | 32 | 40 | 26 | 29 | 30 | 36 | 26 |
| **Family-to-work conflict** | | | | | | | | |
| Low | 21 | 18 | 19 | 14 | 23 | 22 | 24 | 13 |
| Average | 28 | 32 | 28 | 25 | 26 | 30 | 25 | 24 |
| High | 31 | 56 | 38 | 55 | 34 | 50 | 28 | 46 |
| Not applicable/no family | 31 | 32 | 53 | 34 | 20 | 31 | 24 | 23 |
| **Work-to-family conflict** | | | | | | | | |
| Low | 15 | 12 | 12 | 8 | 22 | 19 | 22 | 10 |
| Average | 24 | 24 | 22 | 18 | 25 | 41 | 24 | 18 |
| High | 38 | 52 | 41 | 48 | 31 | 65 | 27 | 35 |
| Not applicable/no family | 31 | 32 | 53 | 34 | 20 | 31 | 24 | 23 |
| **Total** | 25 | 27 | 25 | 23 | 25 | 29 | 25 | 23 |
| **N** | 3142 | 3236 | 701 | 713 | 847 | 875 | 2205 | 2241 |

* Data include only the years 2001-2002 (sub-studies III & IV)

Table 3 Associations between socioeconomic circumstances and poor physical functioning, odds ratios (OR) with 95% confidence intervals (CI) from logistic regression analysis. Helsinki women (N=4807) and men (N=1059)

| | HELSINKI WOMEN | | HELSINKI MEN | |
|---|---|---|---|---|
| | BASE MODEL Age-adjusted OR (CI) | FINAL MODEL Fully adjusted* OR (CI) | BASE MODEL Age-adjusted OR (CI) | FINAL MODEL Fully adjusted* OR (CI) |
| **Parental education** | | | | |
| Higher | 1.00 | 1.00 | 1.00 | 1.00 |
| Intermediate | 1.38 (1.11-1.72) | 1.06 (0.85-1.33) | 1.08 (0.72-1.60) | 0.88 (0.58-1.34) |
| Basic | 1.62 (1.33-1.97) | 1.06 (0.86-1.32) | 1.15 (0.80-1.65) | 0.83 (0.56-1.24) |
| **Childhood economic difficulties** | | | | |
| No difficulties | 1.00 | 1.00 | 1.00 | 1.00 |
| Difficulties | 1.79 (1.52-2.11) | 1.59 (1.35-1.88) | 1.61 (1.11-2.32) | 1.48 (1.01-2.17) |
| **Own education** | | | | |
| Higher | 1.00 | 1.00 | 1.00 | 1.00 |
| Intermediate | 1.65 (1.37-2.00) | 1.53 (1.25-1.88) | 1.57 (1.11-2.21) | 1.51 (1.04-2.18) |
| Basic | 2.37 (1.99-2.83) | 1.90 (1.47-2.45) | 2.10 (1.48-2.97) | 1.84 (1.21-2.80) |
| **Occupational class** | | | | |
| Administrative/managerial | 1.00 | 1.00 | 1.00 | 1.00 |
| Professional/semi-professional | 1.21 (0.91-1.62) | 1.16 (0.86-1.55) | 1.46 (1.03-2.07) | 1.26 (0.88-1.80) |
| Clerical | 2.06 (1.55-2.74) | 1.25 (0.90-1.73) | 2.04 (1.24-3.34) | 1.20 (0.67-2.12) |
| **Household income** | | | | |
| Highest group | 1.00 | 1.00 | 1.00 | 1.00 |
| 2nd | 1.25 (1.01-1.54) | 1.08 (0.87-1.34) | 1.10 (0.72-1.68) | 0.94 (0.61-1.45) |
| 3rd | 1.37 (1.11-1.69) | 1.06 (0.85-1.32) | 1.52 (0.99-2.33) | 1.23 (0.79-1.91) |
| Lowest group | 1.79 (1.47-2.19) | 1.17 (0.94-1.46) | 2.04 (1.31-3.17) | 1.36 (0.83-2.23) |
| **Housing tenure** | | | | |
| Owner-occupier | 1.00 | 1.00 | 1.00 | 1.00 |
| Renter | 1.28 (1.11-1.48) | 0.94 (0.81-1.11) | 1.37 (0.98-1.92) | 1.09 (0.76-1.57) |
| **Current economic difficulties** | | | | |
| No difficulties | 1.00 | 1.00 | 1.00 | 1.00 |
| Occasional difficulties | 1.34 (1.16-1.55) | 1.18 (1.01-1.37) | 1.34 (0.98-1.81) | 1.11 (0.80-1.54) |
| Frequent difficulties | 2.26 (1.79-2.84) | 1.72 (1.34-2.21) | 2.28 (1.29-4.04) | 1.61 (0.88-2.97) |

* Adjusted for age, parental education, childhood economic difficulties, own education, occupational class, household income, housing tenure and current economic difficulties

Among London women and men, the prevalence of poor physical functioning was higher in lower status groups by all other socioeconomic indicators except parental education (Table 2). Among London women, the age-adjusted models confirmed the prevalence percentages (Table 4, base model). The associations observed in the age-adjusted models remained after the full adjustments, current economic difficulties and occupational class being associated with physical functioning (Table 4, final model). Those in the lowest income classes were initially more likely to have poor functioning, but this association weakened after adjusting for occupational class (no data shown) and finally disappeared (Table 4, final model). Among London men, childhood and current

economic difficulties were associated with physical functioning in the age-adjusted models (Table 4, base model). There were also some differences by own education, occupational class and income. After the adjustments, only childhood economic difficulties remained statistically significantly associated with physical functioning (Table 4, final model). For current economic difficulties weak associations remained. No statistically significant interactions were found among women or men.

Table 4 Associations between socioeconomic circumstances and poor physical functioning, odds ratios (OR) with 95% confidence intervals (CI) from logistic regression analysis. London women (N=847) and men (N=2205)

| | **LONDON WOMEN** | | **LONDON MEN** | |
|---|---|---|---|---|
| | BASE MODEL Age-adjusted OR (CI) | FINAL MODEL Fully adjusted* OR (CI) | BASE MODEL Age-adjusted OR (CI) | FINAL MODEL Fully adjusted* OR (CI) |
| **Parental education** | | | | |
| Higher | 1.00 | 1.00 | 1.00 | 1.00 |
| Intermediate | 0.84 (0.46-1.54) | 0.73 (0.39-1.37) | 1.10 (0.80-1.50) | 1.05 (0.76-1.44) |
| Basic | 1.20 (0.72-1.99) | 1.04 (0.59-1.83) | 1.06 (0.78-1.44) | 0.96 (0.70-1.31) |
| **Childhood economic difficulties** | | | | |
| No difficulties | 1.00 | 1.00 | 1.00 | 1.00 |
| Difficulties | 1.32 (0.94-1.86) | 1.23 (0.86-1.76) | 1.48 (1.19-1.84) | 1.46 (1.17-1.82) |
| **Own education** | | | | |
| Higher | 1.00 | 1.00 | 1.00 | 1.00 |
| Intermediate | 1.67 (1.03-2.69) | 1.32 (0.80-2.19) | 0.99 (0.78-1.26) | 0.90 (0.70-1.15) |
| Basic | 1.22 (0.83-1.79) | 0.62 (0.37-1.03) | 1.32 (1.04-1.67) | 1.16 (0.88-1.53) |
| **Occupational class** | | | | |
| Administrative/managerial | 1.00 | 1.00 | 1.00 | 1.00 |
| Professional/semi-professional | 1.90 (1.21-2.98) | 1.81 (1.05-3.10) | 1.28 (1.05-1.57) | 1.13 (0.89-1.45) |
| Clerical | 2.48 (1.53-4.02) | 2.38 (1.21-4.70) | 1.35 (0.89-2.05) | 0.94 (0.56-1.59) |
| **Household income** | | | | |
| Highest group | 1.00 | 1.00 | 1.00 | 1.00 |
| 2nd | 0.86 (0.50-1.49) | 0.67 (0.37-1.21) | 1.13 (0.83-1.55) | 1.04 (0.75-1.44) |
| 3rd | 1.63 (1.01-2.63) | 1.19 (0.66-2.15) | 1.38 (1.06-1.78) | 1.28 (0.97-1.68) |
| Lowest group | 1.80 (1.15-2.81) | 1.14 (0.63-2.07) | 1.31 (1.01-1.69) | 1.08 (0.79-1.47) |
| **Housing tenure** | | | | |
| Owner-occupier | 1.00 | 1.00 | 1.00 | 1.00 |
| Renter | 1.27 (0.71-2.26) | 1.03 (0.55-1.91) | 1.56 (1.03-2.37) | 1.45 (0.92-2.28) |
| **Current economic difficulties** | | | | |
| No difficulties | 1.00 | 1.00 | 1.00 | 1.00 |
| Occasional difficulties | 1.66 (1.18-2.33) | 1.48 (1.03-2.12) | 1.34 (1.09-1.64) | 1.26 (1.02-1.56) |
| Frequent difficulties | 2.43 (1.38-4.27) | 2.14 (1.16-3.95) | 1.71 (1.14-2.57) | 1.45 (0.95-2.24) |

* Adjusted for age, parental education, childhood economic difficulties, own education, occupational class, household income, housing tenure and current economic difficulties

*Common mental disorders*

Next, similar analyses as shown above for physical functioning are presented for common mental disorders. In Helsinki, the age-adjusted prevalence of common mental disorders was 27% among women and 23% among men (Table 2). Participants with childhood and current economic difficulties had a higher prevalence of common mental disorders, but the differences by other socioeconomic indicators were small, in contrast to those shown above for physical functioning. Among Helsinki women, the age-adjusted analyses confirmed the prevalence percentages (Table 5, base model). The adjustment had only small effects on the gradients: the associations between childhood and current economic difficulties and common mental disorders remained strong whereas, in contrast to the results for physical functioning, those for other circumstances remained weak (Table 5, final model). Among Helsinki men, the results were very similar to women. The age-adjusted models confirmed the prevalence percentages (Table 5, base model). Adjustments had minimal effects on the associations and childhood and current economic difficulties remained strongly associated with common mental disorders (Table 5, final model).

In London, the age-adjusted prevalence of common mental disorders was 29% among women and 23% among men (Table 2). As in Helsinki, participants with childhood and current economic difficulties had a higher prevalence of common mental disorders, while differences by other socioeconomic indicators were small and inconsistent. In London women and men the age-adjusted models confirmed the prevalence percentages (Table 6, base model). Among women, adjustments had small effects on the associations (Table 6, final model). The gradients for childhood and current economic difficulties remained and the lowest occupational class showed a lower level of disorders than the other two classes. Among London men, the changes in the associations between the socioeconomic indicators and common mental disorders were mostly minimal when adjusting gradually for the socioeconomic circumstances. After mutual adjustments, both childhood and current economic difficulties remained strongly associated with common mental disorders. Also, as among women, the clerical men had a lower level of disorders than the other classes after the adjustments.

Table 5 Associations between socioeconomic circumstances and common mental disorders, odds ratios (OR) with 95% confidence intervals (CI) from logistic regression analysis. Helsinki women (N=4949) and men (N=1079)

| | HELSINKI WOMEN | | HELSINKI MEN | |
|---|---|---|---|---|
| | BASE MODEL Age-adjusted OR (CI) | FINAL MODEL Fully adjusted* OR (CI) | BASE MODEL Age-adjusted OR (CI) | FINAL MODEL Fully adjusted* OR (CI) |
| **Parental education** | | | | |
| Higher | 1.00 | 1.00 | 1.00 | 1.00 |
| Intermediate | 0.85 (0.70-1.03) | 0.84 (0.69-1.03) | 0.76 (0.52-1.12) | 0.75 80.50-1.12) |
| Basic | 0.85 (0.71-1.01) | 0.82 (0.67-0.99) | 0.81 (0.57-1.15) | 0.76 (0.51-1.12) |
| **Childhood economic difficulties** | | | | |
| No difficulties | 1.00 | 1.00 | 1.00 | 1.00 |
| Difficulties | 1.66 (1.40-1.97) | 1.56 (1.30-1.87) | 1.79 (1.21-2.63) | 1.65 (1.10-2.47) |
| **Own education** | | | | |
| Higher | 1.00 | 1.00 | 1.00 | 1.00 |
| Intermediate | 0.98 (0.84-1.16) | 1.02 (0.85-1.23) | 1.06 (0.76-1.49) | 1.14 (0.79-1.63) |
| Basic | 0.91 (0.77-1.06) | 0.97 (0.76-1.24) | 0.93 (0.65-1.33) | 1.00 (0.65-1.55) |
| **Occupational class** | | | | |
| Administrative/managerial | 1.00 | 1.00 | 1.00 | 1.00 |
| Professional/semi-professional | 1.00 (0.78-1.29) | 0.94 (0.73-1.20) | 0.91 (0.65-1.27) | 0.86 (0.61-1.22) |
| Clerical | 0.90 (0.71-1.16) | 0.77 (0.58-1.03) | 0.77 (0.46-1.27) | 0.67 (0.37-1.20) |
| **Household income** | | | | |
| Highest group | 1.00 | 1.00 | 1.00 | 1.00 |
| 2nd | 1.09 (0.90-1.31) | 1.10 (0.91-.1.33) | 1.03 (0.68-1.56) | 0.98 (0.64-1.50) |
| 3rd | 1.22 (1.01-1.48) | 1.19 (0.97-1.45) | 0.84 (0.54-1.30) | 0.80 (0.51-1.26) |
| Lowest group | 1.28 (1.06-1.55) | 1.15 (0.93-1.42) | 1.13 (0.73-1.77) | 0.98 (0.60-1.60) |
| **Housing tenure** | | | | |
| Owner-occupier | 1.00 | 1.00 | 1.00 | 1.00 |
| Renter | 0.99 (0.86-1.14) | 0.81 (0.70-0.95) | 1.12 (0.80-1.58) | 1.06 (0.74-1.53) |
| **Current economic difficulties** | | | | |
| No difficulties | 1.00 | 1.00 | 1.00 | 1.00 |
| Occasional difficulties | 1.43 (1.25-1.64) | 1.46 (1.27-1.69) | 1.38 (1.01-1.88) | 1.34 (0.97-1.87) |
| Frequent difficulties | 3.10 (2.49-3.85) | 3.29 (2.60-4.17) | 2.91 (1.69-5.03) | 2.65 (1.47-4.78) |

* Adjusted for age, parental education, childhood economic difficulties, own education, occupational class, household income, housing tenure and current economic difficulties

Table 6 Associations between socioeconomic circumstances and common mental disorders, odds ratios (OR) with 95% confidence intervals (CI) from logistic regression analysis. London women (N=875) and men (N=2241)

| | **LONDON WOMEN** | | **LONDON MEN** | |
|---|---|---|---|---|
| | BASE MODEL Age-adjusted OR (CI) | FINAL MODEL Fully adjusted* OR (CI) | BASE MODEL Age-adjusted OR (CI) | FINAL MODEL Fully adjusted* OR (CI) |
| **Parental education** | | | | |
| Higher | 1.00 | 1.00 | 1.00 | 1.00 |
| Intermediate | 1.00 (0.56-1.78) | 1.01 (0.54-1.87) | 0.92 (0.67-1.27) | 0.88 (0.63-1.22) |
| Basic | 0.88 (0.59-1.31) | 0.92 (0.59-1.43) | 0.95 (0.72-1.25) | 0.89 (0.66-1.20) |
| **Childhood economic difficulties** | | | | |
| No difficulties | 1.00 | 1.00 | 1.00 | 1.00 |
| Difficulties | 1.54 (1.11-2.14) | 1.52 (1.08-2.14) | 1.77 (1.42-2.21) | 1.72 (1.38-2.15) |
| **Own education** | | | | |
| Higher | 1.00 | 1.00 | 1.00 | 1.00 |
| Intermediate | 0.89 (0.59-1.36) | 0.91 (0.58-1.44) | 1.06 (0.84-1.34) | 1.04 (0.81-1.35) |
| Basic | 0.79 (0.56-1.12) | 0.84 (0.54-1.33) | 1.08 (0.85-1.38) | 1.12 (0.84-1.49) |
| **Occupational class** | | | | |
| Administrative/managerial | 1.00 | 1.00 | 1.00 | 1.00 |
| Professional/semi-professional | 1.18 (0.82-1.70) | 1.09 (0.70-1.72) | 1.15 (0.94-1.41) | 1.05 (0.82-1.34) |
| Clerical | 0.70 (0.45-1.08) | 0.58 (0.31-1.08) | 0.67 (0.41-1.09) | 0.52 (0.29-0.94) |
| **Household income** | | | | |
| Highest group | 1.00 | 1.00 | 1.00 | 1.00 |
| 2nd | 0.98 (0.63-1.54) | 0.98 (0.61-1.58) | 1.09 (0.79-1.51) | 1.03 (0.73-1.45) |
| 3rd | 1.02 (0.65-1.60) | 1.12 (0.66-1.91) | 0.96 (0.74-1.25) | 0.90 (0.68-1.19) |
| Lowest group | 1.09 (0.73-1.63) | 1.45 (0.84-2.50) | 1.03 (0.80-1.33) | 0.90 (0.65-1.22) |
| **Housing tenure** | | | | |
| Owner-occupier | 1.00 | 1.00 | 1.00 | 1.00 |
| Renter | 0.57 (0.31-1.05) | 0.62 (0.32-1.15) | 1.02 (0.65-1.60) | 1.06 (0.65-1.73) |
| **Current economic difficulties** | | | | |
| No difficulties | 1.00 | 1.00 | 1.00 | 1.00 |
| Occasional difficulties | 1.30 (0.95-1.78) | 1.32 (0.93-1.86) | 1.38 (1.12-1.70) | 1.41 (1.13-1.75) |
| Frequent difficulties | 1.66 (0.96-2.88) | 1.73 (0.95-3.16) | 2.41 (1.64-3.56) | 2.48 (1.63-3.76) |

* Adjusted for age, parental education, childhood economic difficulties, own education, occupational class, household income, housing tenure and current economic difficulties

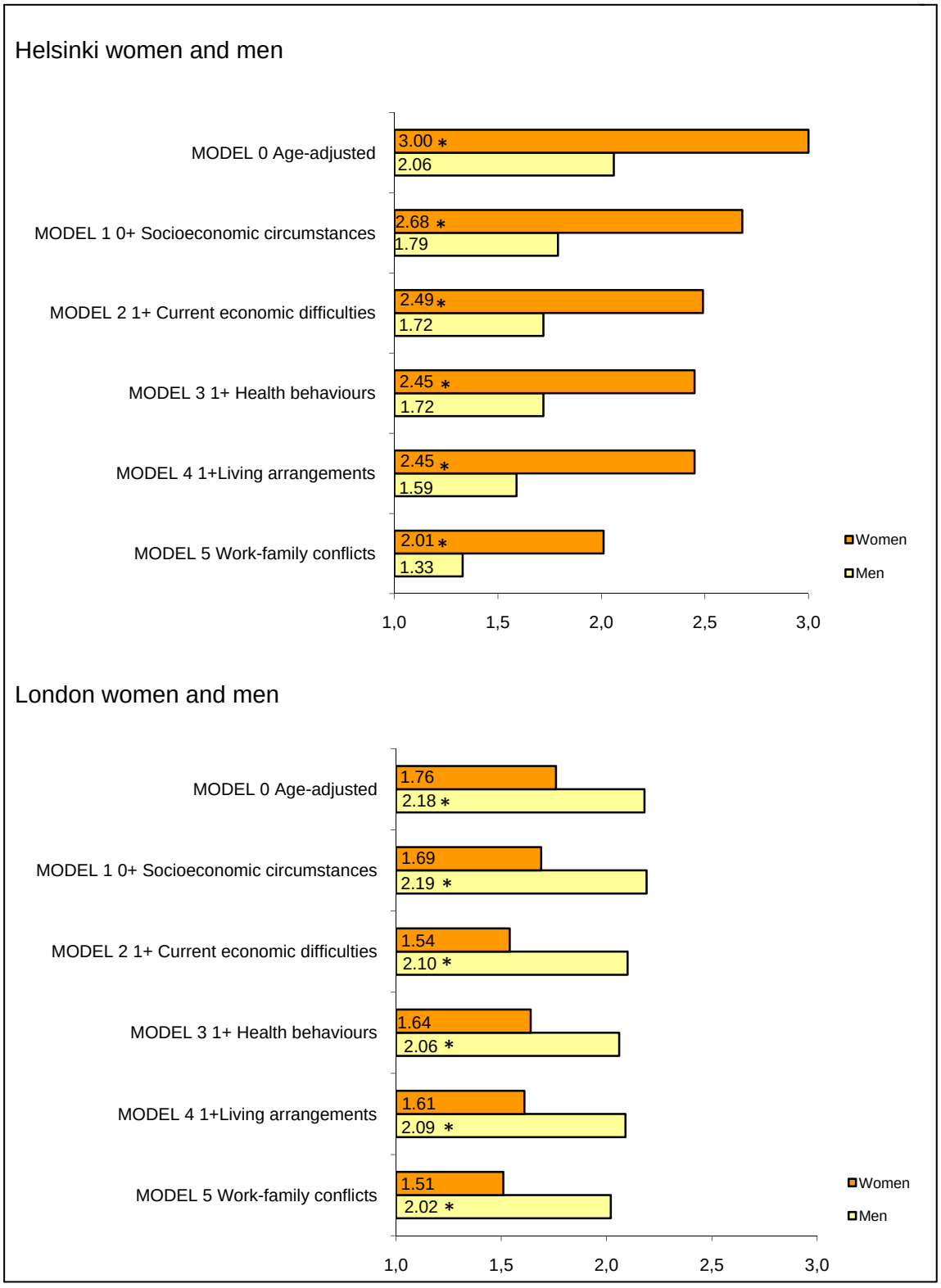
## 6.2 Explanations for the associations between economic difficulties and health (Sub-studies III and IV)

*Physical functioning*

Sub-study III continued from the results obtained in sub-study I. Sub-study III examined the association of childhood and current economic difficulties with physical functioning and the contribution of other socioeconomic circumstances, health behaviours, living arrangements and work-family conflicts to this association. In Helsinki, the age-adjusted initial association between childhood economic difficulties and poor physical functioning was statistically significant in women but not in men (Figure 2, Model 0). Adjusting for other socioeconomic circumstances (Model 1), and further for current economic difficulties (Model 2), affected the association among both sexes. Among women, adjustments for health behaviours (Model 3) and living arrangements (Model 4) had negligible effects, but work-family conflicts (Model 5) attenuated the association by 32% (100*(2.49-2.01)/(2.49-1)). This was somewhat more due to work-to-family conflict (28% attenuation when individually adjusted for) than family-to-work conflict (16% attenuation when individually adjusted for) (data not shown). Also among men, adjustments for health behaviours and living arrangements had only small effects but adjusting for work-family conflicts (Model 5) attenuated the association between childhood economic difficulties and physical functioning by 54%. Again, work-to-family conflict had a slightly stronger effect than family-to-work conflict (data not shown). However, the adjustments did not remove all of the association between childhood economic difficulties and poor physical functioning in both sexes.

In London, the age-adjusted initial association between childhood economic difficulties and poor physical functioning was statistically significant among men, but not among women (Figure 2, Model 0). In London, all of the adjustments had mainly small or negligible effects on the association of childhood economic difficulties with poor functioning among both women and men (Models 1-5), with work-family conflicts having the greatest effect. Thus, the initial association was only slightly reduced after the adjustments.

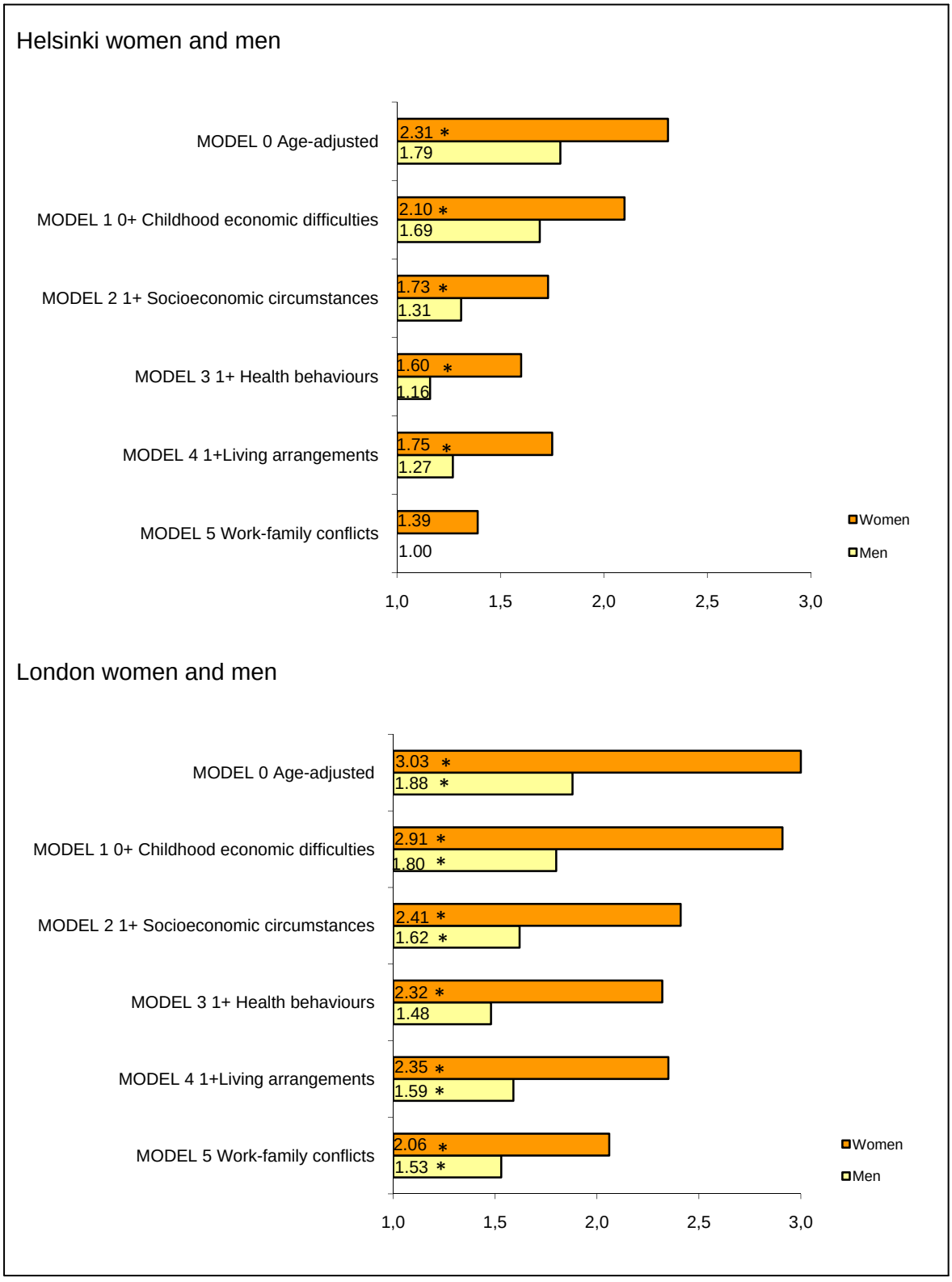
Figure 2. Associations of childhood economic difficulties with poor physical functioning and the contribution of explanatory factors. Relative index of inequality (RII)[a] values from logistic regression analysis, Helsinki and London




* Statistically significant

[a] RII is the relative increase in poor physical functioning from the lowest to the highest score of economic difficulties

Figure 3 Associations of current economic difficulties with poor physical functioning and the contribution of explanatory factors. Relative index of inequality (RII)[a] values from logistic regression analysis, Helsinki and London




* Statistically significant

[a] RII is the relative increase in poor physical functioning from the lowest to the highest score of economic difficulties

In Helsinki, the age-adjusted association between current economic difficulties and physical functioning was statistically significant among women but not men (Figure 3, Model 0). Among women, adjusting for childhood economic difficulties had only a small effect on the association (Model 1), but when all socioeconomic circumstances were adjusted for (Model 2) the association was attenuated by 44%. This attenuation was due to all of the socioeconomic variables (no results shown). Further adjustments for health behaviours (Model 3) and living arrangements (Model 4) had only small effects, but adjusting for work-family conflicts (Model 5) attenuated the association by 47%. This attenuation was equally due to work-to-family and family-to-work conflict (no results shown). Similarly to women in Helsinki, also among men adjusting for childhood economic difficulties had only a small effect, but adjusting for all socioeconomic circumstances (Model 2) attenuated the association between economic difficulties and physical functioning by 61%. This attenuation was due to all of the current socioeconomic circumstances (data not shown). Adjusting for health behaviours (Model 3) caused further attenuation, while adjusting for living arrangements (Model 4) had almost no effect. The association between current economic difficulties and physical functioning vanished when adjusting for work-family conflicts.

In London, the age-adjusted models showed a clear and statistically significant association between current economic difficulties and physical functioning among both women and men, although among women this was even stronger (Figure 3, Model 0). Among women, adjusting for childhood economic difficulties had only minor effects (Model 1), but further adjusting for other socioeconomic circumstances (Model 2) attenuated the association by 30%. This attenuation was mainly due to occupational class and income (no results shown). Further adjustments for health behaviours (Model 3) and living arrangements (Model 4) had small effects on the association. As in Helsinki, adjusting for work-family conflicts (Model 5) had a clear effect. The association was attenuated by 25% although it still remained. Work-to-family conflict had a somewhat stronger effect on the association than family-to-work conflict (no results shown). Also among London men, adjusting for childhood economic difficulties had only a small effect on the association between current economic difficulties and poor physical functioning, but the association was attenuated by 30% when adjusting for other socioeconomic circumstances (Model 2). This attenuation was due to all of the present socioeconomic circumstances (no results shown). Further adjusting for health behaviours (Model 3) and work-family conflicts (Model 5) had some small attenuating effects on

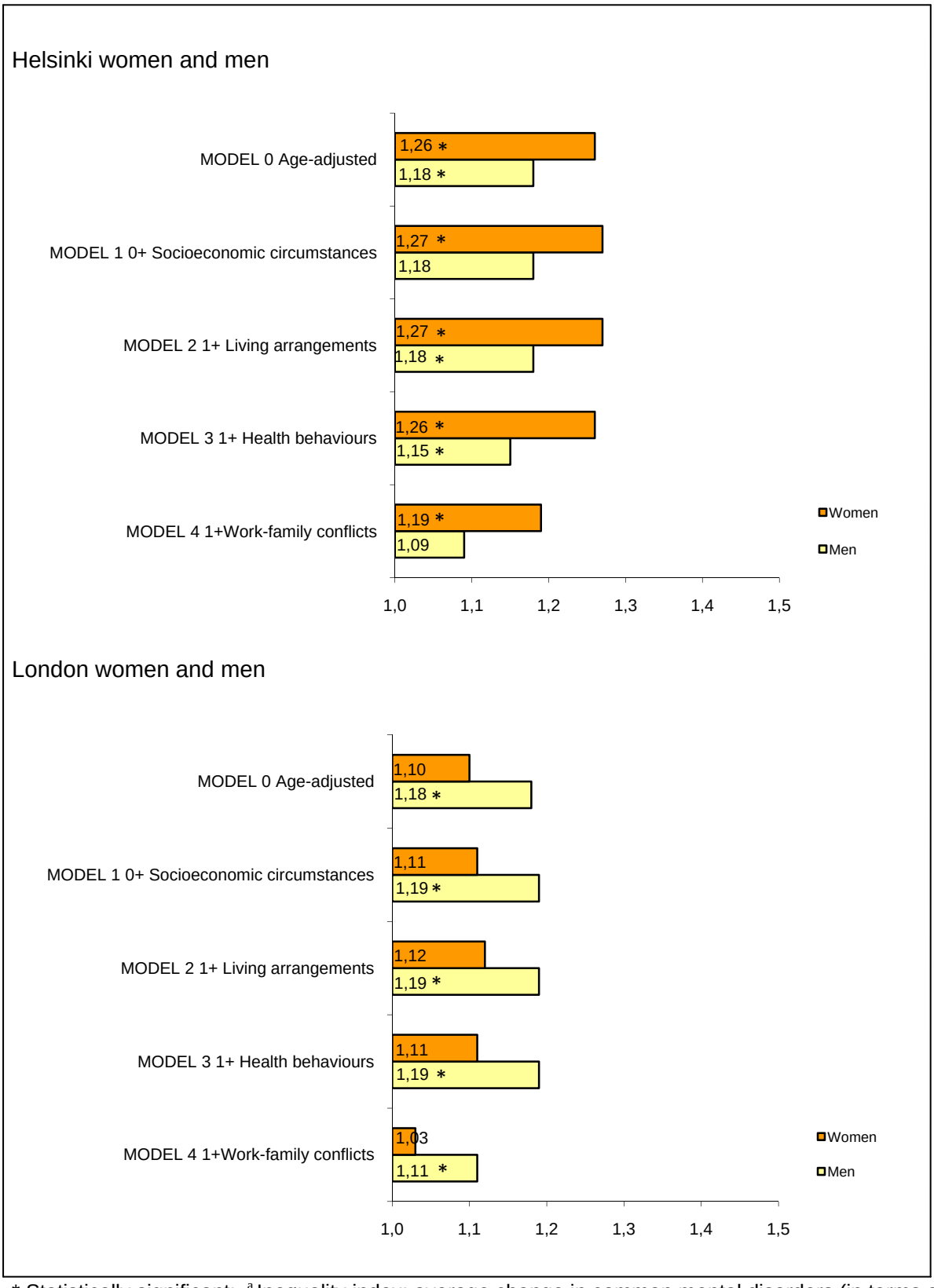
the association, but adjustment for living arrangements (model 4) had practically no effects. The association thus remained after the adjustments.

*Common mental disorders*

Sub-study IV continued from the results of sub-study II and examined the association of current economic difficulties with common mental disorders and the contribution of further socioeconomic circumstances, living arrangements, health behaviours and work-family conflicts to this association. The results are presented as inequality indices which are interpreted as the average change in common mental disorders (in terms of the odds ratio) for each step up in the level of current economic difficulties. In Helsinki the age-adjusted association between current economic difficulties and common mental disorders was somewhat stronger among women than men (Figure 4, Model 0). The association was clearly attenuated when adjusting for work-family conflicts among both women and men (Figure 4, Model 4) but less when adjusting for other factors (Figure 4, Models 1-3). The attenuation caused by work-family conflicts was 30% among women and 50% among men in Helsinki, being slightly more due to family-to-work conflict than work-to-family conflict (data not shown). When testing interactions of household income and work-family conflicts with current economic difficulties, a stronger association between economic difficulties and common mental disorders in lower income groups (age-adjusted inequality index OR=0.77 in the highest and OR=1.39 in the lowest group) was found in Helsinki men (data not shown). Among women there was a similar tendency but this did not reach statistical significance.

In contrast to Helsinki, in London the age-adjusted association of current economic difficulties with common mental disorders was slightly stronger in men than in women (Figure 4, Model 0). As in Helsinki, work-family conflicts attenuated the association (Figure 4, Model 4) while other factors had almost no effect (Figure 4, Models 1-3). Also as in Helsinki, in London women adjusting for work-to-family conflict had a slightly stronger effect on the association than family-to-work conflict, whereas among London men work-to-family conflict was slightly less important than family-to-work conflict (data not shown). Overall, compared to the model with age and socioeconomic circumstances (Model 1), adjusting for work-family conflicts (Model 4) reduced the inequality index value by 73% among women and 42% among men in London. As with Helsinki women, a statistically non-significant tendency for a stronger association between current economic difficulties and common mental disorders in lower income groups was observed in both sexes (data not shown).

Figure 4 Associations of current economic difficulties with common mental disorders (GHQ-12 3+) and the contribution of explanatory factors. Inequality index values[a] from logistic regression analysis, Helsinki and London




* Statistically significant; [a] Inequality index: average change in common mental disorders (in terms of OR) for each step up in the level of current economic difficulties.

# 7 DISCUSSION

## 7.1 Summary of the main findings

This study sought to examine associations of multiple past and present socioeconomic circumstances with physical functioning and common mental disorders in employee cohorts from Finland and Britain. The socioeconomic circumstances included were parental education, childhood economic difficulties, own education, occupational class, household income, housing tenure and current economic difficulties. The study also aimed to find explanations for the observed associations of economic difficulties with physical functioning and common mental disorders by examining the contribution of other socioeconomic circumstances, health behaviours, living arrangements and work-family conflicts. The objectives originated primarily from the lack of studies on socioeconomic health inequalities which would simultaneously consider multiple dimensions of socioeconomic circumstances and domains of health, along with multiple national or cultural contexts. Earlier studies on socioeconomic inequalities in health have for the most part concentrated on examining either single or only a few dimensions of socioeconomic circumstances. Further, those that have focused on the multiplicity of socioeconomic circumstances have been descriptive and limited to one country only. This study thus aspired to fill this gap by combining these different aspects to increase the understanding of the production of socioeconomic inequalities in health.

As the first general finding, the inclusion of multiple dimensions of socioeconomic circumstances proved to be important when studying health inequalities. The associations varied according to the dimensions of socioeconomic circumstances and some interrelations between the dimensions were found as well. Particularly a division between conventional socioeconomic circumstances, i.e. education, occupational class and income, and economic difficulties was emphasized. The associations varied partly also according to the two domains of health. This implicates the importance of studying not only multiple dimensions of socioeconomic circumstances, but simultaneously also multiple domains of health, to attain a more extensive and detailed overall picture of socioeconomic health inequalities. The second general finding was related to studying employees from two national contexts. The overall line of the results was highly similar in the two employee cohorts and sexes, although differences were found in some particular issues. Thirdly, there were a number of more specific results, of which the main ones were the differing associations

of the conventional dimensions of socioeconomic circumstances with physical and mental health, the importance of past and present economic difficulties for both physical and mental health, and finally the importance of work-family conflicts among the various explanatory factors for the associations of economic difficulties with health. These main finding are discussed in the following, beginning with the more general findings related to the framework of multiple socioeconomic circumstances and domains of health as well as the two national contexts. After these, the more specific results are discussed before considering the methodological issues. Finally, conclusions on the basis of this discussion are presented.

## 7.2 Discussion of the main findings

*Multiple socioeconomic circumstances*

Studying multiple dimensions of socioeconomic circumstances simultaneously in their associations with health was the main objective of this study. Both past and present socioeconomic circumstances were included, as well as ones of various degrees of subjectivity and objectivity. The associations varied between the dimensions of socioeconomic circumstances: conventional circumstances, i.e. education, occupational class and income, generally only showed associations with physical functioning, while childhood and current economic difficulties were more consistently associated with both physical functioning and common mental disorders, although even more strongly with common mental disorders. Housing tenure and parental education did not show considerable associations. These results were obtained for the most part in both cohorts and sexes.

Overall, these findings on multiple dimensions of socioeconomic circumstances support the previous suggestions on the different dimensions of socioeconomic circumstances being interrelated but not interchangeable (Braveman et al. 2005, Geyer et al. 2006). First of all, the conventional socioeconomic circumstances were observed to partly mediate each other's effects on physical functioning, which is supported by previous analyses (Lahelma et al. 2004, Singh-Manoux et al. 2002, Dahl 1994). The main divide, however, was that between economic difficulties and conventional socioeconomic circumstances. This has not been much studied as such, but there is some evidence on economic difficulties being more important for mental health than the conventional socioeconomic circumstances, or their association with mental health being at least independent of the conventional circumstances such as income (Skapinakis et al. 2006,

Zimmermann & Katon 2005). Sometimes economic difficulties and other material circumstances have shown associations not explained by other socioeconomic circumstances also with physical health (Ferrie et al. 2005, Duncan et al. 2002). However, for physical health, differences by conventional socioeconomic circumstances are normally found, while this is not always the case with common mental disorders (Lahelma et al. 2006, Fryers et al. 2003, Lewis et al. 1998). Thus, the results of this study that highlight the difference in how economic difficulties and conventional socioeconomic circumstances are associated with physical and mental health are supported by previous findings, although consistent evidence from studies on multiple circumstances is lacking. Reasons for the divide between economic difficulties and conventional socioeconomic circumstances could be related not only to the nature of the measures themselves and to the phenomena they reflect as well as to the health outcomes studied, but also to the characteristics of the cohorts. The cohorts consist of only white-collar employees, which might cause the role of conventional socioeconomic circumstance to be more minor than when studying all groups of employees or general populations (Martikainen & Valkonen 1999). The difference between white- and blue-collar employees is nevertheless the most important division within the conventional socioeconomic circumstances. It should thus be noted that as the characteristics of the employee cohorts may have affected the results, the generalizability to other population groups is limited. The importance of economic difficulties is further discussed below.

Overall, the results of this study suggest that studying multiple socioeconomic circumstances and domains of health is necessary for both improving the research analyses and their possibilities to unravel the production mechanisms of health inequalities, as well as for the concrete attempts to reduce these inequalities. Further investigations would, however, be needed to clarify why economic difficulties are strongly and independently associated with health and why conventional socioeconomic circumstances differ in their associations with health. This endeavour could entail analyses on different health outcomes including clinically validated ones on further domains of health along with mortality, as well as in populations including manual workers, in general population samples and different, particularly older, age groups. Use of other measures of economic difficulties such as ones related to debt could also provide additional information, as would analyses in a longitudinal setting.

*Studying two country-specific employee cohorts*

This study aspired to test the associations of multiple socioeconomic circumstances with health and their potential explanations in two country-specific cohorts to find out whether the cultural and social backgrounds of the two cohorts influence the socioeconomic patterning of physical functioning and common mental disorders. The cohorts consisted of middle-aged women and men working in white-collar positions in the public sector i.e. the City of Helsinki in Finland and the London offices of National Government Civil Service departments in the UK. Thus, not only the national contexts but also the characteristics as specifically white-collar public sector employee cohorts are important.

In terms of similarities and dissimilarities between the two cohorts, it was found that the general associations of multiple socioeconomic circumstances with the two domains of health were highly similar. The less important role of conventional socioeconomic circumstance for common mental disorders along with the importance of past and present economic difficulties for both health outcomes held true in both cohorts. In previous studies comparing populations from various Western countries, mental health has not been included, but in the socioeconomic patterning of general and physical health only small differences have been documented between Finland and Britain (Kunst et al. 2005, Cavelaars et al. 1998, Lahelma et al. 2000, Martikainen et al. 2004, Rahkonen et al. 2000). In the light of these previous findings, the highly similar socioeconomic patterning in the two cohorts was not unexpected. However, as the previous studies have been limited to only a few dimensions of socioeconomic circumstances, differential results could have been obtained in this study as a wider range of dimensions were considered.

Some differences between the Helsinki and London cohorts were, however, found in the way the conventional socioeconomic circumstances were associated with physical functioning, and in the somewhat stronger contribution of work-family conflicts to the associations of economic difficulties with health in Helsinki. The differential results on education, occupational class and income may originate from differences in the class composition of the cohorts due to social and economic historical background. Education might generally be a more important socioeconomic discriminator in Finland than in Britain due to socio-historical factors such as the particular emphasis on education in the last half a century and the related strong upward social mobility (Rahkonen et al. 1997). Differences in the socioeconomic patterning of health between Finland and Britain in general could also be partly related to factors such as dissimilarities in the working life, e.g. higher full-time

labour market participation among women in Finland, as well as a more universal welfare coverage and smaller income differences in Finland than in Britain (Esping-Andersen 1990, Rahkonen et al. 1997, Dahl et al. 2006 Gottschlak & Schmeeding 1997). In this study, the occupation types represented in the cohorts may have also contributed to the differences observed. However, the results that were rather more similar than dissimilar in the two cohorts suggest that the differences between the welfare regimes represented by the two cohorts, the 'liberal' and the 'Nordic', might not be large enough for major differences in the socioeconomic patterning of health to be seen (Esping-Andersen 1990).

As emphasized above, the cohorts share many similar characteristics as white-collar public sector employee cohorts, and it is likely that these factors have influenced the results more than the socio-cultural differences between the countries, even if some differences could still be observed. Overall, the comparison of employee cohorts from two national contexts makes for more credible results, and assures a better generalizability to employees in other Western countries (Martikainen et al. 2004). The both similar and dissimilar findings in the two cohorts of this study warrant further comparisons of health inequalities in a multiple socioeconomic circumstances framework, as it is evident that they would be helpful for increasing the overall understanding of health inequalities in Western as well as other countries.

In this context of comparisons, it should also be stressed that the results were highly similar not only in the two cohorts but also for women and men. All the main findings were almost identical, including the importance of economic difficulties, the associations of conventional socioeconomic indicators with health, as well as the role of work-family conflicts in explaining the associations of economic difficulties with health. Thus, only minor sex differences could be observed and mainly for less central findings, although these were observed only in one cohort at a time i.e. not in a way that the women of both cohorts would differ from men in the two cohorts. There could have been more dissimilarities, as there are nevertheless differences for example in the way women and men are attached to the labour market, in their income levels as well as the type of occupations (Arber & Lahelma 1993). But, as with the national contexts, perhaps the homogeneity of the cohorts as white-collar employees in generally long work contracts in the public sector could have diminished also the differences between women and men.

*Conventional dimensions of socioeconomic circumstances*

The conventionally examined dimensions of socioeconomic circumstances, i.e. education, occupational class and income, were associated with physical functioning but generally not with common mental disorders. Education showed associations with physical functioning in Helsinki, occupational class and income in both cohorts in initial age-adjusted models. The associations were affected by the adjustments, but in different ways in the two cohorts. In the Helsinki cohort, own education partly explained the initial associations of occupational class and household income with physical functioning, whereas in the London cohort occupational class partly explained the association of income with physical functioning. These findings are in keeping with previous studies on multiple socioeconomic circumstances that have documented education, occupational class and income to partly mediate each other's effects on various health outcomes (Lahelma et al. 2004, Singh-Manoux et al. 2002). In the Helsinki cohort, it has been previously observed that education partly explains the associations of occupational class with limiting long-standing illness and self-rated health (Lahelma et al. 2004). In the London cohort, the weaker association of occupational class with physical functioning among men than among women may partly relate to attrition, which is discussed below in the methodological considerations.

The weak or non-existent associations of education, occupational class and income with common mental disorders are in line with a number of previous studies. Although gradients by these dimensions of socioeconomic circumstances have sometimes been found for common mental disorders (Fryers et al. 2003, Muntaner et al. 2003, Harper et al. 2002), also negligible gradients have been documented, particularly among middle-aged employees (Cheng et al. 2002, Hemingway et al. 1997, Lewis et al. 1998, Wiggins et al. 2004). The results of this study thus reconfirm that it is possible for the socioeconomic patterning of common mental disorders to differ from that of physical health. At least this can be observed in employed populations from affluent Western countries.

*Associations of past and present economic difficulties with health*

Of the different socioeconomic circumstances, past and present economic difficulties were most consistently associated with both physical and mental health. In general, participants of both cohorts and sexes reporting childhood as well as current economic difficulties had poor physical

functioning and common mental disorders clearly more often than those without such difficulties. The associations mostly remained after adjusting for the other socioeconomic circumstances. Previous studies have shown current economic difficulties to be associated with self-rated health (Laaksonen M et al. 2005b), incidence of coronary events (Ferrie et al. 2005) and more often with common mental disorders (Cheng et al. 2002, Pudrovska et al. 2005, Skapinakis et al. 2006, Viinamäki et al. 1995, Weich & Lewis 1998). Potential explanations that in the light of previous studies could be suggested for the association between current economic difficulties and health include material and perceived deprivation, physical hardship, an experience of financial uncertainty and impaired social relationships, which can act as acute or chronic exposures and stressors (Pudrovska et al. 2005, Pearlin 1989, Elstad 1998, Weich & Lewis 1998).

First of all, it is notable that as all participants were employed, absolute poverty is unlikely among them. Also, associations of current economic difficulties with both physical functioning and common mental disorders existed at all levels of income, although the association with common mental disorders was slightly stronger in lower income groups (data not shown). It can thus be assumed that serious material deprivation and physical hardship are probably not the best explanations for the result, although it is possible for people to face financial problems regardless of income levels. So, even in the employed population of this study, such problems might occur due to divorce, the partner's unemployment or other strenuous life situations. Also excessive consumption habits and accumulation of debt might lead to financial problems even when the income level is not particularly low (Drentea & Lavrakas 2000, Zimmermann & Katon 2005). Factors like these may be further related to particular lifestyles, one's control over life or personality traits. Although the contribution of debt as such could not be taken into account in this study, a test for net financial assets was conducted in the London cohort but this had little effect on the association of current economic difficulties with physical functioning and common mental disorders (data not shown). Thus, it is unlikely that debt-related deprivation or actual low incomes are major explanations for the finding.

There have been fewer analyses previously on the association of childhood economic difficulties with physical and mental health. Some evidence exists, however, documenting associations of childhood economic and other adversities with adult mental and psychosocial health as well as physical functioning and other physical health outcomes (Pudrovska et al. 2005, Harper et al. 2002, Kestilä et al. 2006, Korkeila et al. 20005, Mäkinen et al. 2006, Rahkonen et al. 1997, Lundberg 1993). It has been suggested that childhood adversities may influence adult health either directly or

indirectly through other factors and later circumstances or by leading to accumulation of disadvantages across the lifecourse (Kuh et al. 2003, Pudrovska et al. 2005). However, the associations of childhood economic difficulties with physical functioning and common mental disorders remained unaffected by adjustments for present circumstances in this study. Correlations between childhood economic difficulties and present socioeconomic circumstances were also low in both cohorts (r=0.01-0.15). Thus, no pathways between past and present circumstances were found.

An issue that should also be noted when interpreting the results on the associations between childhood and current economic difficulties and health is the nature of these particular dimensions of socioeconomic circumstances compared to other ones. Economic difficulties, both past and present, could be considered as more subjective measures of socioeconomic circumstances than education, occupational class and income. Even if the measures used in this study to assess economic difficulties consist of relatively concrete questions on the current ability to pay bills and afford food and clothes along with a question on economic difficulties in the childhood family, they are more subjective and thus more susceptible to the effects of personal perceptions than the more objective conventionally measured dimensions of socioeconomic circumstances. Therefore, it cannot be fully ruled out that the differential results on the ways economic difficulties and other dimensions of socioeconomic circumstances are associated with health, and particularly with common mental disorders, have got something to do with the nature of the dimensions of socioeconomic circumstances and the way they are measured. There could also be other issues related to the way of responding such as negative affectivity, i.e. a disposition to respond to survey questions negatively in general, which might influence the results concerning economic difficulties and health (Bradburn 1969, Watson 1988). However, this could be tested in the London cohort to some extent and was found not to affect the results (data not shown).

*Explaining the associations between economic difficulties and health*

One of the objectives of this study was to examine possible explanations for the observed associations between economic difficulties and health. Previous studies searching for explanations have mainly concentrated on conventional socioeconomic circumstances, which also in this study explained a part of the associations between economic difficulties and health. Furthermore, studies aiming to explain socioeconomic health inequalities have not usually compared populations from different national contexts. The analyses of the possible explanations for the associations between

childhood and current economic difficulties and health included other socioeconomic circumstances, health behaviours, living arrangements and work-family conflicts. There is plenty of previous evidence supporting particularly health behaviours as one group of factors explaining the associations between socioeconomic circumstances and health, according to the behavioural explanation mechanism (Laaksonen M et al. 2005 b&c, Marmot et al. 1981, Stronks et al. 1996, Rohrer et al. 2005). However, in this study it is particularly notable that the association of economic difficulties with health was generally not affected by health behaviours. Similar results have previously been observed in the Whitehall II cohort also for severe medically confirmed physical health problems, i.e. coronary events, which suggests that the finding of this study is not likely to result from self-report bias (Ferrie et al. 2005). As previous results mainly concern conventional socioeconomic circumstances, the lacking contribution of health behaviours on the associations of economic difficulties with health may reflect differences in the characteristics of economic difficulties compared to other socioeconomic circumstances.

In addition, the role of living arrangements was negligible, and instead work-family conflicts appeared as an important explanatory factor. Work-family conflicts partly explained the associations between current economic difficulties and physical and mental health in both cohorts and those between childhood economic difficulties and physical health in Helsinki. The previously suggested psychosocial explanation was thus supported (Elstad 1998). A number of studies have shown that work-family conflicts are associated with mental health and stress (Allen et al. 2000, Chandola et al. 2004, Frone 2000, Grzywacz 2000), as well as general and physical health (Emslie et al. 2004, Grzywacz 2000, Winter et al. 2006). Work-family conflicts have also been shown to vary by education and income, but they have rather been more common in the higher socioeconomic positions by these indicators (Allen & Armstrong 2006, Grzywacz 2002, Grzywacz & Marks 2000, Kinnunen & Mauno 1998, Voydanoff 2004). Childhood economic difficulties in turn can be related to economic difficulties in later life, although in this study the association between childhood economic difficulties and physical functioning was not much affected by adjustment for current economic difficulties (Kahn & Pearlin 2006, Pudrovska et al. 2005).

There is no previous evidence on how economic difficulties in particular are connected with work-family conflicts and with health through them. However, various suggestions can be made on the basis of previous knowledge. These conflicts might act as mediators so that economic difficulties would contribute to them by increasing strain within the family. Work-family conflicts in turn could further affect health and abilities to maintain it, due to stress effects or by being related to health

behaviours (Allen & Armstrong 2006). Economic difficulties might also limit access to childcare or care for elderly parents and have additional negative consequences in terms of strain. Also, simultaneously occurring economic difficulties and work-family conflicts may together increase overall strain which could affect health (Kahn & Pearlin 2006, Pearlin et al. 1997, Pudrovska et al. 2005). Conflicts between work and family and economic difficulties can be closely related, for example by particular family problems affecting work, such as a large number of dependants, being the same problems which lead to economic difficulties. Furthermore, it is possible that some conceptual overlap between work-family conflicts and economic difficulties exists, and they might reflect partly similar phenomena.

Additionally, as the cohorts consist of employees, further tests were made to see whether psychosocial working conditions would have an effect, but job demands, job control and working overtime had no impact on the associations between childhood and current economic difficulties and the health outcomes (data not shown). Overall, the findings from the analyses on the explanatory factors which were to a large degree similar in the two cohorts and sexes, suggest that at least among white-collar employees, economic difficulties may differ from other socioeconomic circumstances with regard to the mechanisms through which they are related to health. This implicates the need for also including other than the conventional dimensions of socioeconomic circumstances when trying to find explanations for socioeconomic health inequalities in general.

### 7.3 Methodological considerations

This study was conducted using cross-sectional data from surveys conducted among public sector employees in Helsinki and London. The comparative design was a strength of the study particularly due to the high comparability of the two cohorts. The measures were highly similar as the Helsinki Health Study data collection largely followed that of the Whitehall II. The time of the data collection differed by only a few years. Furthermore, the participants were male and female white-collar employees from the public sector, and also represented corresponding age groups. However, various issues related to the data and methods of the study that can be considered as limits in this study are addressed in the following.

*Cross-sectional design and causality*

As this study was conducted based on cross-sectional data, causal interpretations should be made with caution. A possibility of selection exists, one example of that being health-related selection, which means that poor health can lead to and influence a low socioeconomic position. However, it has been suggested that the causal direction is more likely to be from socioeconomic status to health than vice versa (Benzeval & Judge 2001, Blane et al. 1993). In the Whitehall II Study it has been shown that health affects the social position much less than the social position affects health (Chandola et al. 2003).

*Bias and attrition*

In surveys, non-response bias may affect the results. In the Helsinki cohort the overall response rate was 67%, and women and those in higher socioeconomic positions had a somewhat higher rate. However, previous analyses have shown that the bias does not seriously affect results concerning relative differences in health by socioeconomic status (Martikainen et al. 2007, Laaksonen M et al. 2008). In the London cohort the baseline response rate was 73% and that of the fifth phase 76%. Non-response to the baseline and follow-up has been shown to be associated with higher mortality, an association that was not modified by socioeconomic position (Ferrie et al. 2009). In self-reported survey data there is also a possibility for reporting bias. Responses might be influenced by the respondents' poor health, although this is likely to apply more to mental than physical health. Particularly the retrospective questions about childhood conditions might be affected. However, retrospective information on childhood adversities has been widely used and the measurements have shown good reliability (Dube et al. 2004, Krieger et al. 1998). Furthermore, phrasing of the questions or the respondents' tendency to underreport may have affected the responses.

Earlier phases of the Whitehall II study did not include all the socioeconomic measures needed in this study so data from phase five was used. The time of the data collection was also close to the Helsinki Health Study data collection, which increases the comparability. Furthermore, the basic associations of the socioeconomic indicators available in phases one and three with physical functioning and common mental disorders were checked, and these were practically similar to those obtained with phase five data (data not shown). However, for the Whitehall II study fifth phase data, attrition has to be considered. Attrition has been more common in the lowest occupational

class, which may have particularly affected the occupational class gradient among men, attenuating the class differences. Attrition may also have been more common among those with poorer health and thus attenuated the socioeconomic differences.

*Characteristics of the cohorts and comparability*

The participants in the two cohorts included white-collar employees only, which may cause the generalizability to be limited. As the cohorts consisted of employed persons only, some of the socioeconomic variations in health might be smaller than in general populations (Martikainen & Valkonen 1999). Additionally, despite the overall homogeneity, differences exist between the cohorts in the job types represented. The employees of the City of Helsinki work in general local government administration, healthcare, social welfare, education, culture, public transport, technical and construction services. However, only white-collar employees were included to increase comparability with the civil servants ranging from clerical and office support to executive officers and administration in the Whitehall II cohort. Also, both cohorts consist of public sector employees from the capitals of the countries, which increases their comparability with each other, but it should be noted that they do not represent general populations. Finally, when comparing populations from different national and cultural contexts, it should be noted that cultural and social differences may exist that affect participants' interpretation of the survey questions and their responses to them. However, the effects of these kinds of factors are likely to be small as the national contexts in this study are nevertheless relatively similar, both being affluent Western European societies. There were also differences between the cohorts in the sex distribution, the proportion of women being larger in the Helsinki cohort (80%) than in the London cohort (28%). This may have affected the results somewhat, as particularly the associations observed among the small number of Helsinki men did not always reach statistical significance.

*Measures*

There is a possibility of multicollinearity of the different socioeconomic indicators which may lead to instability of parameter estimates of regression models. Socioeconomic indicators are correlated as they reflect a broader construct which cannot be directly measured. The socioeconomic indicators used in this study show mutual correlations varying from r=0.003 to r=0.61, with the

highest correlations being between own education and occupational class in Helsinki (r=0.61) and between household income and occupational class in London (r=0.53). An earlier analysis of the multicollinearity of the socioeconomic indicators used in this study showed acceptable values, with the highest variance inflation factor value being 2.56 for education (Laaksonen M et al. 2005b). With regard to the measures, there were some differences between the cohorts in the ways the data was collected. For example, the body mass index measure was based on self-reported data in Helsinki and on screening data in London. There were also slight differences in the formation of some of the survey questions, such as that concerning economic difficulties/paying bills which was asked in a different direction in the two cohorts.

### 7.4 Conclusions

This study examined the associations of multiple socioeconomic circumstances with physical and mental domains of health in public sector employee cohorts from Finland and Britain. The study produced new evidence on the ways different dimensions of socioeconomic circumstances are associated with different domains of health along with possible explanations, as previous studies on socioeconomic health inequalities have not combined these elements simultaneously in a comparative setting. Although there has been a lack of studies combining the examination of multiple socioeconomic circumstances, multiple domains of health, explanations and multiple populations, suggestions have been made about the importance of considering the different dimensions of socioeconomic circumstances (Braveman et al. 2005, Geyer et al. 2006, Lahelma et al. 2004). This study reconfirms the previously expressed necessity of analysing the different dimensions of socioeconomic circumstances. Differential results were obtained for conventional circumstances which were associated only with physical health, and past and present economic difficulties which were associated with both physical and mental health, particularly strongly with the latter. The findings were highly similar for the two cohorts and sexes, which increases their significance and generalizability.

As in various earlier studies, the conventional socioeconomic circumstances partly mediated each other's effects. A particularly interesting finding of this study was the importance of economic difficulties. Past and present economic difficulties have been shown to be associated with health but previous evidence on the mechanisms of these associations, and on the differences between economic difficulties and conventional socioeconomic circumstances, is scarce. When searching for

explanations for the associations in this study, it was found that work-family conflicts and to a lesser extent socioeconomic circumstances explained part of the associations in both cohorts. This supports the previously suggested psychosocial explanation mechanism for associations between socioeconomic circumstances and health (Elstad 1998, Macintyre 1997). In contrast, the behavioural explanation was not supported as health behaviours did not explain the associations of economic difficulties with health. The findings on the explanations thus further underline the differences between economic difficulties and conventional socioeconomic circumstances and between the mechanisms through which they are associated with health.

The overall findings highlight that measures of different dimensions of socioeconomic circumstances indeed reflect different elements of a person's socioeconomic circumstances and can be differentially associated with health outcomes. The findings thus warrant the considering of material circumstances such as economic difficulties along with other dimensions of socioeconomic circumstances in further research. Confining only to the conventional dimensions of socioeconomic circumstances is not enough in health research that aspires to understand the mechanisms behind socioeconomic inequalities in health. Also when attempts are made to reduce socioeconomic health inequalities, of which an international example is the WHO Commission on Social Determinants of Health (Marmot 2005), taking into account the different dimensions of socioeconomic circumstances would help to better identify where the health-related risks are greatest. The results also underline the importance of considering different domains of health when inspecting socioeconomic inequalities. Finally, the findings highlight the need for supportive policies related to economic difficulties and work-family conflicts. Ways to prevent conflicts between work and family life could include both work-related organizational support and family support policies (Voydanoff 2004). Supporting people in both economic difficulties and work-family conflicts could be ways to help employees to maintain physical and mental health, and to diminish health inequalities at least among the employed population.

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**APPENDIX** Appendix table 1. Distribution of participants (%), Helsinki* and London

| | Helsinki women % | Helsinki men % | London women % | London men % |
|---|---|---|---|---|
| **Age** | | | | |
| 45-59 | 28 | 24 | 32 | 36 |
| 50-54 | 26 | 24 | 38 | 44 |
| 55-60 | 46 | 52 | 29 | 20 |
| **Parental education** | | | | |
| Higher | 21 | 29 | 27 | 22 |
| Intermediate | 26 | 25 | 17 | 25 |
| Basic | 54 | 46 | 56 | 53 |
| **Childhood economic difficulties** | | | | |
| No difficulties | 82 | 85 | 71 | 75 |
| Difficulties | 18 | 15 | 29 | 25 |
| **Own education** | | | | |
| Higher | 27 | 42 | 34 | 41 |
| Intermediate | 34 | 32 | 21 | 31 |
| Basic | 39 | 26 | 45 | 27 |
| **Occupational class** | | | | |
| Administrative/managerial | 8 | 26 | 24 | 50 |
| Professional/semi-professional | 44 | 62 | 45 | 44 |
| Clerical | 49 | 12 | 31 | 6 |
| **Household income** | | | | |
| Highest group | 21 | 24 | 31 | 35 |
| 2nd | 29 | 27 | 20 | 14 |
| 3rd | 25 | 28 | 22 | 26 |
| Lowest group | 26 | 22 | 28 | 25 |
| **Housing tenure** | | | | |
| Owner-occupier | 70 | 77 | 91 | 95 |
| Renter | 30 | 23 | 9 | 5 |
| **Current economic difficulties** | | | | |
| No difficulties | 57 | 62 | 54 | 57 |
| Occasional difficulties | 36 | 32 | 39 | 38 |
| Frequent difficulties | 7 | 6 | 7 | 6 |
| **Living arrangements** | | | | |
| Alone | 25 | 23 | 32 | 22 |
| With spouse/partner | 26 | 28 | 33 | 23 |
| Alone with children | 7 | 3 | 2 | 2 |
| With spouse/partner and children | 22 | 30 | 7 | 20 |
| Other | 21 | 16 | 26 | 33 |
| **Current smoking** | | | | |
| No | 79 | 76 | 87 | 83 |
| Yes | 21 | 24 | 13 | 17 |
| **Heavy drinking** | | | | |
| No | 93 | 93 | 87 | 88 |
| Yes | 7 | 7 | 13 | 12 |
| **Physical inactivity** | | | | |
| No | 80 | 79 | 74 | 75 |
| Yes | 20 | 21 | 26 | 25 |
| **Obesity** | | | | |
| No | 85 | 86 | 81 | 87 |
| Yes | 15 | 14 | 19 | 13 |
| **Family-to-work conflict** | | | | |
| Low | 48 | 52 | 33 | 32 |
| Average | 37 | 35 | 40 | 48 |
| High | 8 | 8 | 13 | 13 |
| Not applicable/no family | 7 | 5 | 15 | 7 |
| **Work-to-family conflict** | | | | |
| Low | 18 | 19 | 13 | 10 |
| Average | 59 | 57 | 49 | 48 |
| High | 17 | 19 | 22 | 34 |
| Not applicable/no family | 7 | 5 | 15 | 7 |
| **Total** | 100 | 100 | 100 | 100 |
| **N** | 3261 | 718 | 967 | 2430 |

* Data include only the years 2001-2002 (sub-studies III & IV)